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Preface

The African Academic Research Forum (AARF), through the South Africa International Conference on Education (SAICEd) provides opportunity for researchers, academics in education and all other relevant stakeholders to gather and share ideas related to teaching and learning in the 21st century.

This Book of proceedings of the 8th edition of the conference contains full papers that have gone through a rigorous, blind peer-review process. We received a total of 62 full papers for possible presentation and publication from participants in eight countries. The final number of papers accepted was 41.

Our thanks go to the keynote speaker, the presenters of workshops, and all reviewers who, through their expertise have assisted in improving manuscripts to appear in the conference proceedings. Finally, we thank the editors who have worked very hard to produce the proceedings.

Prof A. Mji
Conference Chair

Reviewers of full papers

The organising committee of SAICEd 2020 would like to thank the following reviewers of the full papers and others whose names do not appear in the list.

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Review Process

In total, 84 manuscripts in different areas within the field of education were received. Of these manuscripts, 62 were full papers. All the full papers were subjected to a double-blind review. Each paper was reviewed by at least 2 reviewers. The reviews were carried out by experts in the different fields of education based on 22 criteria of the full paper evaluation form. Following the review process, the editorial committee considered the reviewers' comments and 21 manuscripts were found to be unsuitable for publication. Reports were sent to the authors of the remaining 41 papers with suggestions of what they needed to address for the papers to be published. After receiving the re-worked manuscripts, the editorial committee finally accepted the 41 full papers for inclusion in the proceedings.

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INTEGRATING INDIGENOUS TECHNICAL SKILLS INTO TVET CURRICULUM: HUMAN RESOURCE DEVELOPMENT STRATEGY FOR YOUTH EMPLOYABILITY IN SOUTH AFRICA

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Abstract

Youth unemployment poses a threat to the South Africa's stability. The threat is seen in the violent protests and xenophobic attacks on foreign entrepreneurs in recent years, which led to loss of lives, destruction of properties, businesses, and tarnishing of the country's image. The causes of youth unemployment are rooted in the country's history as the apartheid government designed a poor school system and curriculum for blacks and this legacy is a major cause of unemployment in the country today. Technical and vocational colleges have been established to equip the youth with practical skills for employment. This study employed interviews to explore the prospects of integrating indigenous technical skills into the curriculum of TVET Colleges to enhance youth employment. The study found that the integration of indigenous skills into TVET programmes could enhance youth employability. The study recommended the inclusion of indigenous skills in TVET College programmes to boost youth employment.

Keywords: *Curriculum, empowerment, human resources, youth employment, skills*

Introduction

The high unemployment among the youth in South Africa has its roots in the country's political history. Bhola (1997) affirms that the apartheid educational system was designed to maintain a socio-economic order, which would continue to keep the white a boss and the black in bondage. To achieve this aim, the curriculum for black schools did not include the learning of practical skills for employment. This legacy of poor school system is the cause of high unemployment rate in the country. It is argued that communities, civil society and the government must come together to equip the youth with practical skills to avoid a catastrophe. The frequent violent protests by the youth and the concomitant xenophobic attacks on small businesses and their owners in the townships are cases in point. Quan-Baffour (2012) asserts that because the formal school did not teach technical skills its products only crave for white-collar jobs and regard the trades as mean jobs. They become disappointed when they do not find jobs and vent their frustrations on the most vulnerable in society i.e. the black foreign business owners. This study used the indigenous Akan philosophy of *Sankofa* and the empowerment theory as its theoretical foundation to stress the need to revisit indigenous trades for job creation.

The Legacy of Irrelevant School Curriculum and the Need to Integrate Indigenous Skills into TVET College Programmes

Education is the tool for socio-economic advancement since it is through education that socio-economic norms, values and aspirations are transmitted from generation to generation. An important pillar of education is the *curriculum*. Tamakloe (1992) defines Curriculum as "the whole body of courses offered in an educational institution". *Curriculum*, covers the courses or subjects specified by the Ministry of Education that are to be taught at each grade as well as the amount of time devoted to each (Barakett & Cleghorn, 2000). In this article

curriculum covers all the planned teaching and learning activities for which an educational institution is responsible. It is the formal and informal context and the process by which learners gain knowledge and understanding, develop skills and alter attitudes, and values under the auspices of the school.

The school curriculum of South Africa like the other countries in Africa is euro-centric and deliberately designed to suit the educational agenda of the colonial administrators but not the context, needs, and aspirations of the African people. It is argued that the poor school curriculum designed by colonialists is the major cause of unemployment in the country. The colonialists, in tandem with the Missionaries, established schools to serve their own interests. Rodney (2009) attests that the main purpose of colonial school was to train Africans to help man the local administration at the lowest ranks and the capitalist firms owned by Europeans. To avoid competition for work and European market, indigenous knowledge and skills were not integrated into the school curriculum. Africans therefore lost indigenous technical knowledge and skills e.g. sculpturing, brewing, smith works, food processing, sewing, knitting, leather works, pottery moulding and handicrafts. It is argued that in this era where technical knowledge and skills matter most, indigenous job skills must be integrated into TVET curriculum to enhance job creation among the youth.

Although political freedom has been achieved the school curriculum does not reflect the realities and aspirations of the country's socio-economic interest and context. The schools still turn out unskilled graduates. Arguably, the development of South Africa depends on the relevance and functionality of the school curriculum hence the need to innovate it in line with current national socio-economic imperatives. Curriculum innovation refers to the process of introducing changes into the existing one to make it more relevant (Adentwi & Sarfo, 2009). The technical, vocational, education and training colleges have the mandate to equip the unemployed youth with skills for employment (DHET, 2013). However, as Ncobela (2020) observes the TVET colleges seem to have started on wrong footing in that they lack infrastructure, sufficient resources and inadequate trained lecturers for pedagogical shift to meet the current conditions. Secondly the curriculum has not been sufficiently developed, reformed and modernised (Ncobela, 2020). For the TVET colleges to address the skills shortage of the country their programmes must be more responsive to the needs of the labour market. Indigenous technical knowledge and skills should be integrated into their programmes to enhance job creation. Truly, for curriculum to serve real purpose, it must equip the child with the necessary skills for modern living; and it must help to keep the child a fully integrated member of his community (Salia- Bao, 1989).

The integration of indigenous technical knowledge and employable skills into the curriculum of TVET Colleges can change the world of most of the unemployed youth. As Nelson Mandela (1918-2013) observed, "education is the most powerful weapon which you can use to change the world". Technology and science need to be deconstructed in a manner that incorporates African values, knowledge and skills to empower the socio-economically marginalised citizens of the country. Teaching in TVET colleges should not be restricted to Western science and technology but must include indigenous knowledge and skills to develop human resources for the country.

Studies carried out on the subject in recent times vindicate the importance of learning indigenous technical skills for employment. Studies by Quan-Baffour (2008) and Bell (2007) found out that practical training in indigenous trade skills equipped unemployed church women and young male and female refugees with tangible skills for a living in Ghana and

Australia respectively. Although the studies were conducted in different countries the outcomes suggest that the learning of indigenous trades in TVET College can enhance job creation and contribute to human resources development for the fourth industrial revolution in South Africa.

Objectives of the Study

The objectives of this study were to explore how the integration of indigenous technical knowledge and skills into TVET college curriculum could boost self-employment among the unemployed youth of South Africa and increase human resources development of the country.

Research Questions

In line with the objectives stated above the following research questions were formulated to guide the study.

- What effect will the integration of indigenous knowledge and skills have on TVET graduates?
- How will the integration contribute to human resources development of South Africa?
- How can the learning of indigenous technical skills be formalized?

Theoretical Framework

This study was underpinned by two theories- *Sankofa* and empowerment- which the authors deemed relevant to human resources development for youth employment in the country. The two theories are briefly discussed below.

Sankofa: The term *Sankofa* comes from three Akan (Ghanaian) words – [*san*] return, *ko* [go] and *fa* [take]. Put together as one word *Sankofa* literary means go back to reclaim the best in the past in order to move forward. It is an indigenous philosophy symbolically depicted by a bird whose neck is turned backwards as it flies. The meaning of the symbolic posture of the bird is that it is never too late to ‘go back’ to the past to collect something, which can correct the current situation. *Sankofa* teaches that there is nothing wrong to ‘go back’ to your past to reflect on it to enable you move forward. Quan-Baffour (2012) affirms that the bird with its neck turned backwards while flying tells Africans ‘to reach back and examine their past to ensure the future’. Dzobo (1976) affirms that *sankofa* is a critical reappraisal of our indigenous culture to restore it to its true image by discovering its potential for the improvement of the quality of life.

The theory has important lessons for Africans in that it teaches them to return to their past while grounded in the present in order to know and understand who they are, where they are coming from and where they are going. *Sankofa* goes beyond the literal meaning because it urges Africans to go back to reclaim the best of their past to enable them recognise their identities and aspirations for the achievement of their destiny. The lesson from *Sankofa* is that Africans should look back to their past to integrate the best indigenous values, knowledge, and skills, into formal education for socio-economic advancement. Colonial policies overshadowed indigenous technical knowledge and skills such as manufacturing of clothes, blankets, footwear, and alcoholic drinks. These can now be revisited for job creation and economic development of the country.

Empowerment theory: To address the problem of unemployment among the youth, they need to be empowered hence the allusion to the *Empowerment Theory* of which Perkins and Zimmerman (2005) are the main proponents. To empower means to strengthen or provide

energy to someone who is weak or lack knowledge or skill. Perkins and Zimmerman (2005) describe the term as ‘an intentional ongoing process centred in the local community, involving natural respect, critical reflection, caring and group participation, through which people lacking an equal share of valued resources gain greater access to and control over those resources’ Empowerment is a process of assisting people to gain control over their lives through the acquisition of relevant knowledge and skills to enable them participate in the socio-economic activities of their communities. Empowerment is a process that enables individuals to participate in relevant learning activities to acquire specific skills for employment. Perkins and Zimmerman, (2005) attest that the participation in collective activities can lead to the achievement of primary personal goals such as the acquisition of skills for self-employment. The theory is premised on the principle that individuals and group participation in relevant activities facilitated by an expert in specific skills can lead to building of capacities for all the participants. Jooste (2009) opines that empowerment relates to the use of a person’s potential and competencies, the discovery of new expertise and creation of new opportunities to apply such competencies.

The theory has implications for the unemployment situation in South Africa where due to lack of relevant job skills and knowledge many youths and adults are unemployable. The lack of employable skills among the youth might not only impede personal development but can hinder the development of the country. The youth should be equipped with job skills to enable them find or create their own work. The basic social problems of society may be solved when all those who are willing to work are able to find something to do because work can assist people to organise their lives.

Research Methodology

This phenomenological case study explored the prospects of integrating indigenous job oriented knowledge and skills into the curriculum of TVET colleges. According to Brink, van der Walt and van Rensburg (2012) phenomenological studies “examine human experience through the descriptions that are provided by the people involved, answering the question *what is it like to experience this or that?*”. The authors adopted the phenomenological method in order to obtain the descriptions and interpretations the participants would provide on their lived experiences. They purposively chose three campuses of a TVET college as the sites for the study because as Yin (2014) attests, a case study can be conducted at more than one site A recent study by Molema & Quan-Baffour (2019) on ACET centres in rural areas of Limpopo revealed high dropout among adult learners because the learners were not taught practical skills which they needed for job creation. In the same rural area, there are few indigenous tradesmen and women engaged in sculpturing, weaving, leather works (shoe making and repairs), handicrafts and brewing of local drinks. These current researchers purposively chose the three campuses in those particular rural areas for an in-depth study with the assumption that the integration of the indigenous technical skills into TVET programmes would formalize the learning of indigenous skills, be attractive to TVET students and boost their job opportunities. Welman, Kruger and Mitchell (2007), attest that in a case study researchers are directed towards understanding the uniqueness and the idiosyncrasy of a particular case in all its complexity. In this study the spotlight was on the acquisition of practical skills by the unemployed youth for employment. The curriculum of all the three TVET college campuses in the study follow exotic (western) programmes devoid of indigenous technical skills such as handicrafts, sculpturing, brewing of local beverages, and designing and manufacturing of footwear and African cloths.

Selection of Participants

The researchers contacted the registrars' offices at the three (3) campuses of the TVET college for the list of first year students. The first year students were targeted because they are at the threshold of the TVET programmes and might benefit from any innovations to the curriculum. The researchers used the simple random sampling technique to select five (5) students from each college. They purposively recruited six (6) lecturers and administrators made up of three (3) HODs and three (3) Principals from the three college campuses to participate in the exploratory investigation. The six were purposively selected because as lecturers and principals they were regarded by the researchers as information rich individuals who could contribute immensely to the achievement of the investigation. The total number of participants for the exploratory investigation was twenty-one (21) i.e. (15) students and six (6) academics- lecturers and principals.

The eligibility criteria used for participation were that:

- Participant should be TVET first year student/ academic or principal
- Participant must be economically active man/woman.
- She/he lives or has experienced life of the countryside

The above criteria were used to ensure that those recruited into the study were information rich and could contribute to the achievement of the objectives of the investigation.

Data Collection

After identifying the 21 participants the researchers requested for permission from the college authorities to interview them telephonically because of the covid-19 lockdown, which made the physical presence of both the participants and researchers impossible. Those who had *whatsApp* were interviewed via that facility whilst others were interviewed through direct cell phone calls. The researchers first contacted the selected participants to introduce themselves and made individual appointments with them for the telephonic interviews. They used the opportunity to tell them the purpose of the study.

The interviews centred on:

- what hinders the youth from getting employed.
- the indigenous technical skills that can enhance employment
- how to formalise the transmission and learning of indigenous technical knowledge and skills

Trustworthiness

Trustworthiness refers to the level of dependability or reliability of the data gathering instrument, the process carried out in data collection, the quality and validity of the data (Quan-Baffour, 2015). To ensure trustworthiness or the credibility of the investigation and the findings the researchers requested an academic colleague to evaluate the interview items to ensure that they were easy to understand and may elicit the kind of data required for the study. They also kept journals in which all the information they obtained from the participants were jotted down. In the cases where participants' responses were not clear the researchers requested them to repeat or clarify any information or responses. The responses

obtained from the various participants were compared to find out where they corroborated or differed.

Ethical Consideration

The issue of ethics is very important in any research involving human lives. Brink, van der Walt & van Rensburg (2012) intimate that the rights of the participants and how researchers protect such rights is important in research. The researchers adhered to ethical principles listed below in order to protect the participants.

- They first informed the participants of the purpose of the interview to allay their fears and to request for their free will to participate in the investigation.
- The participants were informed that participation in the study was voluntary and they could withdraw from it at any time if so wished.
- The participants were assured that the information they provided was purely for the study and would not be divulged to any person or organisation.
- In addition to the above the researchers did not request the names or student numbers of the participants

Results and Discussion

The study explored the value of integrating indigenous technical knowledge and skills into TVET College curriculum. The demographic information revealed that 9 of the 15 student participants were females and 6 males who were between the ages of 18-25. Of the 6 lecturers and principals, four (4) were females and two males. The information above confirms the fact that the student participants were adults who knew what they wanted to learn in order to acquire relevant employable skills.

To make the data analysis manageable the researchers pruned the data from the field and coded them before doing the analysis. They used the open coding approach where each segment of the data was marked with descriptive words to identify all related information. The coding process enabled the researchers to quickly retrieve and collect together all the texts and other data which were related (Nieuwenhuis, 2012). The three themes which emerged after the coding were analysed and discussed here below.

Theme 1: Hindrance to youth employment

The participants were asked, what is the major challenge to youth employment. The responses from all the 21 participants confirmed that unemployment is high in the rural areas among the youth because of lack of employable skills and paucity of job opportunities. The indication is that the economically active people want to work but cannot find work because of lack of job skills. The situation can be blamed on the legacy of the colonial school system which turns out job seekers instead of job creators. The responses point to the urgent need to transform the school curriculum to ensure that its graduates are equipped with practical skills for job creation. Thus, for the school curriculum to serve a real purpose it must equip the child with the necessary skills for modern living; and it must help to keep the child a fully integrated member of his community (Salia-Bao, 1989).

One female participant from campus A affirmed this, verbatim, when she said,

everywhere I go employers require specific technical skill. I realise that school education alone can't land me work.

The participants also corroborated in their responses that in an environment where job opportunities are scarce the unemployed need to think and act creatively in order to survive.

Thinking creatively means learning practical skills that can lead to self-employment. The following verbatim response from one of the male students from campus B epitomises the views of the others:

there is scarcity of jobs in the country and to survive we need to think on our feet. One has to learn some practical indigenous skills to create own job and even employ others for survival.

Thus, survival has the capacity to encourage the youth to ‘gaze back’ to indigenous technical knowledge and skills to create their own work to ease the economic burden on families and also contribute to the country’s economic development. Thinking on their feet might indicate looking backwards like the *sankofa* bird to do critical reappraisal of the indigenous technical skills so as to restore it to its true image by discovering their potential for the improvement of the quality of human life (Dzobo, 1976).

Theme 2: Indigenous technical skills that can enhance youth employment

Regarding the kind of indigenous technical skills that could enhance employment and job creation, the participants mentioned many indigenous trades or technical skills they have seen in their communities including cobbling, sculpturing, weaving and leather works (making of bags and footwear) as indigenous technical skills which the youth can learn to make a living but most of them look down on the trades. Five of the student participants from all the three campuses corroborated with two academics from Campuses B and C that job oriented indigenous technical skills are not offered at the TVET colleges at the moment.

The student participants agreed with the principals from the three campuses that many youths having been to school find it shameful or uncomfortable to go back to learn indigenous technical skills outside educational institutions to be instructed by illiterate tradesmen and women. Eight of the student participants from all the three campuses mentioned that employers require certificates as proof on learning but these cannot be obtained when one learns job skills from the tradesmen.

The above responses indicate that the unskilled youth require evidence based empowerment to enable them unearth their potentials and competencies; the discovery of new expertise and creation of new opportunities to apply such competencies (Jooste, 2009).

Theme 3: Formalising the transmission and acquisition of indigenous technical skills

When asked how the indigenous technical skills can be transmitted to the youth, the participants gave interesting responses. All the participants agreed that the teaching and learning of job oriented indigenous technical skills can be formalised by integrating them into the TVET programmes. Two of the principals agreed with the lecturers that the youth would take the learning of indigenous knowledge and skills seriously when they are taught in the colleges because they may receive certificates as evidence of acquisition of practical job skills.

The academic participants (6) agreed that without integrating them into formal courses many of the youth might regard indigenous technical skills as trades for the illiterate and may not patronise them. This observation is important because of the negative attitude of the youth towards indigenous apprenticeship. The youth respect and desire certificates or diplomas offered by colleges as evidence of learning and as such they might not patronise the instructions via indigenous apprenticeship. The respondents agreed that to attract the youth to indigenous technical skills e.g. designing and sewing of local outfits, footwear, sculpturing

and handicrafts, the skills must be formalised- made part of the TVET programmes. These responses call for curriculum innovation through changes to the existing one to make it more relevant (Adentwi & Sarfo (2009). The mandate of the TVET Colleges is to equip the unemployed youth with practical skills for employment hence the need to integrate indigenous skills into their programmes to boost students' chances of employment. Education is the most powerful tool which can be used to change the world (Mandela, 1918-2013). The TVET Colleges can change the world of the students through the integration of indigenous technical knowledge and skills into their programmes.

Conclusion

This study explored the prospects of integrating indigenous knowledge and skills into TVET programmes to boost skills acquisition among the unemployed youth. The findings validate the assumption that unemployment is high among the youth because schools do not teach them employable skill; and to improve the situation TVET Colleges should integrate indigenous skills into their programmes

The findings contribute immensely to knowledge in teaching, learning and curriculum innovation in the post-school education sector of South Africa. The study concludes that to reduce unemployment among the youth it is prudent to *gaze back* to indigenous technical skills and integrate them into the formal programmes of the TVET colleges.

Recommendations

Based on the findings the study made the following recommendations to TVET stakeholders:

- Indigenous skills e.g. handicrafts, sculpturing, leather works and weaving of African fabrics should be taught in schools to equip learners with practical skills for job creation.
- The learning of trade skills must be integrated into TVET programmes to make the attractive to the youth.
- In the era of Africa's rebirth, indigenous skills must be part of formal study programmes.

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CONCEPTIONS OF INTEGRATED STEM EDUCATION APPROACHES IN PHYSICAL SCIENCES BY PRESERVICE TEACHERS

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Abstract

The preparation of science teachers is one vehicle that promotes and advances the STEM education agenda. Since most methods courses for the science, technology, engineering and mathematics disciplines are taught independently, integration approaches are some of the instructional strategies available for preservice teachers to teach STEM education. This study explored five final year physical sciences conceptions of STEM education teaching through an interpretive case study of a phenomenon. The integrated model of STEM education was used as a conceptual framework. Data were collected by means of semi-structured interviews and lesson plans to elicit the preservice teachers' conceptions of STEM education integration in physical sciences. Content and thematic data analysis techniques were used to make sense of the data collected. The findings showed that the preservice teachers conceptualised integrated STEM as the teaching of physical sciences in real-world and problem solving contexts, and the teaching of the science concepts by making use of technology, engineering and mathematics as required. A recommendation for further research is made.

Keywords: *Integration approach, Physical sciences, STEM Education,*

Introduction and background

The STEM education innovation is underpinned by its potential to stimulate economic growth through innovations and development of expertise. Du Plessis (2018) asserts that 75% of the fastest growing occupations require STEM skills. Some of the key drivers of STEM education are that it is a response to global economic challenges; it is a way of solving the global technological and environmental problems, and it is a systematic method of developing a skilled workforce that will drive the nations' economic growths (Bybee, 2013). STEM education is therefore a global innovation and countries recognise the need to come up with effective education programmes through basic schooling and tertiary education to achieve the aspired economic growth.

Bartels, Rupe & Lederman (2019) confirm that STEM education has permeated international curricula. However, the teaching of STEM education is not without challenges and Saxton *et al.* (2014) highlight learner under performance in STEM subjects, shortfalls in teachers' preparation and practice, and poor assessment methods in developed and developing countries alike. In addition, the term STEM education is viewed as ambiguous (Srikoom, Faikhamta & Hanuscin, 2018) possibly because it can be both content and instructional approaches without specifying what these actually are (Dare, Ring-Whalen & Roehrig, 2019). One clear thing about STEM education is that the teaching of the constituent disciplines should not happen in isolated silos but unfold in integrated ways causing them not to have fixed boundaries (Du Plessis, 2018). However, Çinar, Pirasa, Uzun and Erenler (2016) highlight deficiencies in programmes that prepare teachers to teach STEM education and Du Plessis (2018) indicate that the focus should be on capacitating the teachers. One way of ensuring that STEM teachers are capacitated is to prepare them during initial teacher training. STEM education can be distinguished by how it should be taught in the classrooms. Nikirk (2012) asserts that STEM pedagogy is trans-disciplinary in nature, inquiry-based, project-

based, and set in real-world applications that present learners as active participants in building new content understanding.

It is against this backdrop of an increased endorsement of STEM education and the need to capacitate teachers that this study explored the conceptions of physical sciences preservice teachers of integrated STEM education by asking, “*What are the physical sciences preservice teachers’ conception of the integrated STEM education?*” Besides having theoretical implications by adding insights to integrated approaches of STEM education in physical sciences, this study further has implications for practice in the preparation of preservice science teachers. The study findings serve as a reflection point on how teacher educators can integrate STEM education preparation in the methods courses. Ring, Dare, Crotty & Roehrig (2017) point out that it is important for teachers and in this case teacher educators to reflect on how they implement STEM education in the classrooms so that they can implement it better.

Literature review

STEM education has attracted the attention of many nations due to the belief that it is seen as a panacea for some of the environmental and economic challenges experienced in the 21st century. William (2011) points out that the USA, the UK and South Africa are some of the countries that have put in place national initiatives to promote STEM education. At national level STEM education is meant to support and sustain economic growths through innovation and expertise development and is a strategy being used by the leading economies (Yildirim, 2016). At school level the goals of STEM education include increasing advanced training and careers in STEM fields, expanding a capable STEM workforce for the 21st century industrial revolutions, and increasing scientific literacy for all learners (Kennedy & Odell, 2014). Implementation strategies in the classroom include the use of real-world contexts, models of how science, technology, engineering and mathematics together would be used in STEM careers, the development of twenty-first century skills and competencies such as problem-solving, and the use of learner-centred pedagogies (Dare *et al.* 2019). These instructional strategies are rooted in the learning theory of social constructivism in which learning is supported by authentic environments and social interactions (Vygotsky, 1978). The fact that STEM education is anchored in real-world contexts and problem-solving aligns it to the active learning methods enabled by social constructivist approaches.

In Thailand, Pimthong and Williams (2018) point out that STEM education is supported by the government but bemoan the absence of deliberate efforts to prepare teachers for STEM education in institutions of higher learning. Similarly, Çinar *et al.* (2016) indicate that in Turkey teacher capacitation programmes for STEM education are lacking. STEM education integration into preservice teacher preparation becomes one of the systematic ways of capacitating teachers in the implementation of the innovation in the classrooms. Bartels *et al.* (2019) support the idea of exposing preservice teachers to opportunities in which they can design and develop STEM teaching and learning materials. A study conducted in Thailand by Pimthong and Williams (2018) to investigate how preservice teachers understand STEM education showed that the preservice teachers understood STEM education to be an integration of disciplines. However they could not explain how the integration should be done. Kennedy and Odell (2014) suggest that teacher educators and school teachers should work together to develop robust pedagogical models for teaching STEM education in the classrooms. Ring *et al.* (2017) also believe that teachers should be assisted to develop beliefs and conceptions of STEM education through collaborative approaches of professional development. A study by Cooke and Walker (2015) that explored STEM education through

pre-service teacher conceptualisations in mathematics, noted that the preservice teachers thought that STEM education is when mathematics is used to make personal decisions and when it is relevant to the learners' everyday lives. Similarly, this study sought to explore the preservice teachers' conceptions of the integrated STEM education in the teaching of physical sciences.

Integrated approach to STEM education

STEM education means different things to teachers and therefore the way that it is taught in the classrooms varies considerably. Dare *et al.* (2017) and Dare *et al.* (2019) identify eight models that are used by teachers in the classroom in the name of STEM education. First, STEM education is implemented through the teaching of science and/or mathematics in separate classrooms with little emphasis in the role of technology and engineering pedagogies. This approach could be exemplified through high school curricula in which science and mathematics electives take centre stage in preparing learners for university entrance and further education. Bybee (2010) notices that engineering and technology disciplines are not actively included in school curricula. Second, STEM education is taught through real-world problem solving approaches that seek to provide real-world contexts and thereby making STEM concepts relevant to students' lives. Making STEM concepts relevant to learners' everyday lives has been observed by Holbrook and Rannikmae (2009) as an issue that needs to be attended to for improved learning outcomes and learner motivation. Third, STEM is implemented by the teaching of science and scientific concepts by making use of technology, engineering and mathematics as a means to achieve the objectives. Fourth, similar to the previous model STEM education is implemented through the teaching of engineering calling upon science, technology and mathematics where necessary. Fifth, STEM education manifests as science, technology, engineering and mathematics taught separately but including other disciplines in supporting roles in ways that are not meaningful. This model is in contrast to what is proposed by Du Plessis (2018) in which the teaching of STEM education is conducted in an integrated manner with no boundaries amongst the disciplines making STEM education a discipline in its own right. The sixth approach entails the use of the engineering design process context models where learners engage in iterative engineering design activities in order to learn science and mathematics using technology. The seventh approach is a variation of the preceding model because STEM education is taught through both science and the engineering design process making use of mathematics and technological when required. The eighth model uses a confluence or combination of science, technology, engineering and mathematics to teach STEM education. This model could be more in line with the integration model proposed by Du Plessis (2018) in which the boundaries between the disciplines become blurred and not taught in silos. However, a question may still be asked on how teachers may be able to achieve that kind of integration given the background that the methods courses for science, technology, engineering and mathematics are taught separately (Bartels et al. 2019). What can be understood from the discussed models above is that the teaching of STEM education can be placed on a continuum from silo approaches in which the use of other STEM subjects is minimal to integrationist approaches which have increased inclusion of other STEM concepts. In this paper, I make the assumption that all the approaches use integration methods to teach STEM education depending on whether it is done minimally or significantly. Perspectives abound on how the integration approaches can be put into practice. Bybee (2010) considers STEM education to be "an integrated curricular approach to studying grand challenges of our era.... challenges such as: energy efficiency, resource use, environmental quality, and hazard mitigation." This perspective seems to resonate with the model that advocates for the use of real life contexts that are relevant to the learners' everyday lives (Holbrook & Rannikmae,

2009; Dare *et al.*, 2017; Dare *et al.*, 2019). Similarly, Kennedy and Odell (2014) explain that STEM education can be a meta-discipline in which the traditional barriers among science, technology, engineering and mathematics fall away and the focus will be put on innovation. On the backdrop of the many ways to practise integrated STEM education this study's interest was to explore how the conceptions of this approach have formed in physical sciences preservice teachers.

Methods and study context

In this qualitative explorative case study (Yin, 2007) conducted at one South African university, the conceptions that final year preservice teachers had of integrated STEM education through physical sciences were explored. The use of the case study allowed for the exploration of the phenomenon of interest because the researcher was able to ask questions and request data that were specific to the context of physical sciences teaching. Zainal (2007) says that case studies allow for a close examination of the phenomenon within a specific context. The interpretive paradigm allowed for meaning making through the interpretation of data and the construction of the preservice teachers' conceptions based on their perspectives (Thanh, N.& Thanh, T. 2015).

Sampling and Procedures

Five final-year physical sciences preservice teachers who were in a four-year Bachelor of Education (BEd) programme in 2020 were purposely selected from a cohort of 20 students, first, because they could be accessed easily through an online communication platform, Google Meet that allowed video-calling. Some of the preservice teachers had trouble accessing gadgets that would enable them to be interviewed through Google Meet. The online communication platform was used in order to observe the social distancing requirements brought about by the COVID "19 pandemic. Google Meet was preferred because it is available to users with a Gmail application and there is no need to download extra applications. Second, purposive sampling ensured that the BEd preservice teachers who were the richest data source were selected because they were in final year and had more teaching practice experiences than other groups of preservice teachers. Data collection was facilitated by semi-structured interviews with each of the five preservice teachers and they were also requested to submit lesson plans that they had designed to teach STEM education in physical sciences. The trustworthiness of the data collected was ensured by developing the instruments based on the integrated STEM education conceptual framework which in turn is anchored in social constructivism.

Data collection

The five selected preservice teachers were composed of three female (P1, P2 and P3) and two male (P4 and P5) students between 22-24 years of age. The preservice teachers will be referred to as P1- P5 in the findings of the study section. The semi-structured interview protocol had 5 questions as displayed in Table 1. Table 1 shows the interview questions and how the data was identified and coded.

Table 1: Semi-structured interview questions and data indicators

	Interview question	Data indicators
1	What does STEM education mean to you?	-can mention integration models -can provide a definition for STEM education
2	How can STEM education be taught?	-can give examples of activities -can give examples of instructional strategies
3	What are the benefits of STEM	-can mention the purpose of STEM education

	education?	-can mention the importance of STEM education -can describe the uses of STEM education
4	What methods can be used to teach STEM education?	-can list methods that can be used to teach STEM education
5	How does the teaching of physical sciences contribute to STEM education?	-can describe the role of physical sciences in the STEM education and agenda

The researcher had an opportunity to follow-up on the participants' responses during the video-calling sessions on Google Meet. The lesson plan data was used to consolidate the interview data and provide for triangulation. The lesson plan data analysis framework consisted of the following elements, physical sciences topic used, STEM education objectives (skills and knowledge to be developed in learners), STEM education integration approach and STEM education learner activities.

Data analysis

The data collected were analysed by means of directed qualitative content and thematic analysis techniques. The process involved coding of data using the frameworks described above followed by organising the data in emerging themes. Themes emerged on how the preservice teachers defined STEM education, perceived the purpose of STEM education, perceived integrated STEM education approaches, and described STEM education teaching approaches.

Findings of the study

The physical sciences preservice teachers' conceptions of integrated STEM education are arranged in five themes which are defining STEM education, STEM education purpose, STEM education integrated and STEM education teaching approaches.

Defining STEM education

Two definitions of STEM education were deciphered from what the five preservice teachers said. First, was the broad understanding that STEM education was the teaching and learning of STEM subjects. P1 and P5 said, "STEM education refers to teaching and learning in the science, technology, engineering and mathematics fields." Similarly, P3 mentioned the subjects that are involved in STEM education by saying, "STEM education is a word for science, technology, engineering and mathematics." Second, P2 and P4 seemed to view STEM education as form of integrating two or more subjects during teaching and learning.

P4 said,

As we have learnt from the definition of STEM that for us to teach STEM we need to incorporate the different fields into one. Now to teach STEM in physical sciences classrooms we need to also incorporate it with mathematics and other related subjects.

P2 also thought that STEM education is an integration of the disciplines and that the integration should show the relationship between them when she said,

STEM education is the teaching of science, technology, engineering and mathematics in an integrated way. Students will understand the relationship between science and technology.

The five preservice teachers showed that they were already forming an understanding of what STEM education means and were aware of the implied connection among science, technology, engineering and mathematics.

STEM education purpose

In displaying their conceptions of the integrated STEM education the preservice teachers also defined STEM education by the goals that it can be used to achieve. P1 indicated that STEM education may be used to address some of the social injustices portrayed as gender and ethnic inequalities. She said, “STEM instruction makes a difference to bridge the ethnic and gender access opportunities in some cases found in math and science areas.” P4 opined that STEM education will equip learners with skills to solve real life problems in the context of the 21st century suggesting that this can be achieved through project-based assessment. He said,

I have been stressing the fact that STEM education allows learners to be able to solve real life problems. So, STEM assessment is mainly based on projects which address 21st century skills and allows teachers to make assessment that will help learners understand content more effectively and think critically to solve the problems.

P2 also supported the notion that through STEM education learners get equipped with problem solving skills. She said, “Students will be able to define a problem and design a solution.” P2 went on further to explain how STEM education can help to develop skilled manpower and increase expertise in STEM fields. She said,

By encouraging students to develop and maintain interest in STEM subjects, you are preparing the next generation of researchers, engineers, scientists and programmers to meet the growing demands for qualified STEM professionals

The cited preservice teachers above seemed to believe that STEM education was capable of helping learners develop problem-solving skills that can be applied in real life situations. The preservice teachers also thought that universal access to STEM education is a tool to address social injustices. Lastly, STEM education was seen as a career path to key STEM fields’ professions and the development of important expertise.

STEM education integration

Under this theme the preservice teachers showed how they conceived integrated STEM education in physical sciences teaching. P5 thought that STEM education integration is not just the teaching of STEM subjects separately without bringing them together in a defined context. He said,

I have learnt the true essence of STEM education, which can be easily misinterpreted for just introducing technology and engineering knowledge to learners whereas it entails contextual integration of all STEM education fields and practical applications relevant to real-life

P5 made a demonstration by providing an activity in the lesson plan that he would use to show the STEM education integration in physical sciences. He chose an activity that require learners to look at the properties of carbon and lithium (chemistry) and how these can be applied in technology and engineering for battery making. P5’s learners’ activity was as follows,

- i. Define special properties of carbon and describe its use in engineering and technology
- ii. Carbon is used for making dry cells like zinc-carbon batteries and lithium batteries which are used in modern cellphones. How are lithium batteries solving issues surrounding battery life and overheating?

The example of the activity showed what P5 meant by integrating science, technology and engineering in context and how such a context is relevant to the learners' real-life experiences. P3's example of an integrated STEM education approach showed how under the topic of electricity in physics, she would go on to engage her learners in hands-on activities by building circuits and make measurements. She said,

Electric circuits it will be the topic that I will be teaching in Grade 11 physical Sciences. Whereby we will be building the circuits together with my learners and afterwards we will be measuring the current, voltage and resistance, with the results we will connect our device to the computer so that it can plot the graph of our results. They will be divided in groups of four whereby after getting results each and every group will have to present the results to each other to share information.

Electricity as a topic is relevant to the learners' everyday lives and according to P3 the learners would be given opportunities to develop skills by building circuits and taking measurements which is similar to what is done by electrical technicians and engineers in real life. The learners would also have opportunities to develop mathematical skills and use information and communication (ICTs) technologies as they plot graphs. The example given by P3 demonstrates the teaching of physics with the help of mathematics, technology and electrical engineering concepts. P2 gave her example of integrated STEM education when she described a project that could be given to learners to show how bungee jumping can be designed. She said,

Take "Bungee Jumping" design as an example. The situation was that the students had to design their own "Bungee Jumping" with one rope from any materials with the condition that when the kilogram of sand bag which is a substitute for a human body was released at the height of meters, the lowest falling level of sand bag had to be at centimetres above the ground.

Although P2 did not indicate the physics concept involved which can only be implied from the example, the project would allow the learners to think about the strength of the rope (technology) and engage in mathematical calculations and length measurements. The preservice teachers' conceptions of integrated STEM education show that everyday life contexts were used to teach physical sciences. Integrated STEM education teaching occurred when mathematics, technology and less explicitly engineering concepts were used to help in the solving of problems and designing of solutions through the teaching of physical sciences.

STEM education teaching approaches

The preservice teachers made attempts to explain how they will go about teaching STEM education. One of the perspectives that came out of the data was that the physical sciences content would be taught first before applying it to real world situations. To demonstrate this perspective P3 said,

First, you teach learners whereby you transfer knowledge to them so that they can understand, secondly you engage learners within the lesson whereby you check their level of understanding and lastly you take learners to the field or expose them to the real world materials of which they work as a team and to conduct experiments so that they can learn through one another.

P3 pointed out the importance of hands-on activities such as fieldwork and experiments and the need for learners to collaborate. Similarly, P5 was of the opinion that the STEM content should be introduced to the learners in a logical and well organized manner making sure the connections among the STEM disciplines are well established for the learners to see. P5 said,

Once knowledge is introduced, I ensured it is organized in a logical and understandable manner such that the relational memory of learners is activated. There must be clear links established between the different STEM fields when integrating technology and engineering.

P4 explained how he would guide learners to think about some of the solutions that can be used to address the current problems experienced in real life contexts such as the impact of human activities on the environment. P4 said,

The lesson deals with the chemical industry which is the main topic. Under this we will be paying special attention to types of fertilizers and their impact on the environment. The long-term aim of this content will be to raise questions to learners as to how can we substitute these industrial fertilizers or reduce their impact on the environment which is basically the real world application of the lesson.

The approaches suggested by the preservice teachers show that the physical sciences concepts can be applied to real life contexts that serve as authentic environments for learning. The authentic environments allow learners in hands-on activities and teamwork. The approach also gives learners opportunities to design solutions to some of the problems experienced in real life.

Discussion and conclusion

This study explored the physical sciences preservice teachers' conceptions of the integrated STEM education. The study contributes to literature on how physical sciences preservice teachers conceptualise integrated STEM education. The findings can also be used by the researcher who is a physical sciences teacher educator to reflect on her practice when preparing the preservice teachers for STEM education. The preservice teachers could provide definitions for STEM education both by identifying the constituent disciplines (science, technology, engineering and mathematics), and also as an integrated discipline. Similarly, Pimthong and Williams (2018) made a finding that the preservice teachers in their study understood STEM education to be an integration of disciplines.

The preservice teachers were also aware of some of the broader goals of STEM education such as its potential to (i) develop learners' problem solving skills in real life contexts,(ii) develop learners' career paths in STEM fields (Kennedy & Odell, 2014), and (iii) the potential to bridge social justice gaps existing among the genders and the different ethnic groups through universal access. Two out of the eight models by Dare *et al.* (2017) and Dare *et al.* (2019) of STEM integration could be identified from the preservice teachers'

conceptions. First, the preservice teachers described the teaching of STEM education through real-world problem-solving approaches by using examples of real contexts that are relevant to the learners' lives. Bybee (2010) points out that STEM education presents learners with opportunities to study global challenges and Holbrook and Rannikmae (2009) say that making learning relevant improves interest and motivation in science. Second, the preservice teachers described an integration approach in which the physical sciences concepts are taught and technology, engineering and mathematics are used where necessary. However, when the preservice teachers were asked to describe the teaching approaches it was evident that they believed that the physical sciences concepts should be taught first before they could implement the integrated STEM education. This finding opens up questions on how the preservice teachers would implement the integrated STEM education approaches they described in real classrooms.

Study limitations and recommendations

This study's findings are limited in that the preservice teachers' conceptions of integrated STEM education are based on self-reported perspectives and designs of lesson plans without observing classroom practice. Therefore, a further study on how the preservice teachers implement the integrated STEM education in physical sciences classrooms is recommended.

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ASSESSING MICRO AND MACRO-TEACHING STRATEGIES IN SCIENCE TEACHING: A SOUTH AFRICAN PERSPECTIVE

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Abstract

Literature highlights that science instructional strategies must be diverse to encourage an active learning approach that enhances both mental thinking and physical skills in learners. The purpose of the study was to investigate the instructional strategies that Natural Science teachers use to promote science learning. The descriptive survey design was employed in the study. The study was informed by social constructivism. Thirty out of sixty-seven schools were selected using simple random sampling. Cronbach's alpha test was used to ascertain the scale reliability of the questionnaire. The findings revealed that teachers mostly use the following strategies: Investigation 97% (n=29); Discussion, Presentation and Project 93% (n=28); Problem solving 90% (n=27); Demonstration and Question and Answer 87% (n=26); Case study and Brainstorming 77% (n=23); Role-play 63% (19) and Lecture 57% (17). While the least used strategies are modelling 47% (n=14), Inquiry 27% (n=8), and Simulation 23% (n=7). The study, therefore, recommends that Natural Sciences teachers should make use of different teaching strategies in their lessons to enhance interactive learning that will encourage critical thinking.

Keywords: Natural Sciences, instructional, strategies, teachers

Introduction

Promoting critical thinking in science education is extremely important since science plays an immense role in the economy of any country. Science is an increasingly important field thus, literature confirms that critical thinking skills allow students to be able to solve problems during the learning of Natural Sciences (Rubini & Sofyan, 2013; Demirhan & Koklukaya, 2013). Also, the science field needs instructional strategies that will promote deep learning e.g. problem skills, critical thinking. Constructive alignment is the key aspect when applying the science teaching strategies. Hence Biggs (2014) highlight that constructive alignment includes what students should learn and how they will display their accomplishment of the intended learning outcomes.

Education for Sustainable Development (ESD) notes that promoting science-literate societies is very important as it allows individuals to be able to make informed decisions concerning the natural environment and the advancement of sustainable livelihoods (Breiting and Schnack, 2009). It is also highlighted that critical thinking skills also involve higher-order thinking skills that enhance active engagement and prepare students to apply logical thinking (Lanning & French, 2017). Therefore, the researchers believe that to enhance the learning and teaching of science, relevant instructional teaching approaches are needed when implementing the science curriculum. These approaches should encourage critical thinking that will promote interactive learning and deep learning.

Akdeniz (2016) emphasise that instructional strategies are methods used by teachers to interact with students and they promote effective teaching when used proficiently. Richardson (2001) avers that Lev Vygotsky, Jean Piaget, Jerome Bruner and Albert Bandura studied instructional strategies and produced cognitive psychology and constructivist approaches. Furthermore, Richardson (2001) points out that both these theories positioned

instructional strategies such as exploration and research-based teaching activities in the centre of the curriculum. Concerning the centre of the curriculum, the present researchers are of the view that for teaching to be successful it needs to be reinforced by theories. The teaching strategies link with the theory that informs this study, namely social constructivism. Hence, in this study, the theory and strategies will be used often because of the connection between them.

Saskatchewan Education SEd (1985, 1991) explains that instructional strategies refer to individual and specialized fields and they are divided into macro and micro strategies. Macro strategies involve active engagement and metacognition and micro strategies include higher-order thinking, co-operative learning and independent practice/homework. Both the macro and micro strategies stimulate learning. For a module to be implemented effectively, the relevant strategy is needed. Using micro and macro strategies, science education can be taught efficiently.

Statement of the problem

Existing research acknowledges that students' interest in science is not regarded as a potential indicator of a future career, or as a key interest that will be their path after finishing schooling (Fensham, 2008). Moreover, Fensham (2008) states an important factor that contributes to low interest in science by students as the method that is implemented for teaching and learning of science. In addition, science education is in terrible need of approaches that involve learners more in a lesson for example, promotion of self-activity, promotion of self-development, stimulation of interest and curiosity (Youssef & Mohammed, 2016). Thus there is a need to combine various methods of teaching, using them correctly to fit the actual situation (Youssef & Mohammed, 2016). The researchers propose that for science teaching to be implemented effectively, there is a need for macro and micro strategies since they both involve active engagement. Hence, the researchers delved deep to assess the strategies used by teachers in teaching Natural Sciences.

Objectives

To assess both macro and micro strategies used by Natural Sciences teachers to enhance science learning.

Research questions

What are the macro and micro strategies used by Natural Sciences teachers to enhance science learning?

Literature review

Active engagement and metacognition

Active engagement is very important; one needs to involve the students to convey knowledge effectively. Thus, previous studies note that one of the key features of the constructivist theory of learning is the learner being actively engaged in learning (Zhu, Ennis & Chen, 2011). Metacognition is explained as the method of reflecting on and guiding one's thinking (The National Research Council, 2001). Again, Literature highlights that, metacognition is closely related to learning instruction and is related to student inspiration (Dinsmore, Alexander & Loughlin, 2008). Hence, Zul (2011) emphasizes that students with advanced metacognition can take ownership of their learning. That means students become independent in their learning and become more motivated.

Micro and macro-teaching strategies

According to Saskatchewan Education (1985, 1991), macro and micro teaching strategies have something in common, that is, active student engagement. The macro strategy contains two aspects that are metacognition and active student engagement. Demonstration is the teaching strategy whereby the educator is the main actor and students watch to take part at a later stage (Ekeyi, 2013). Recent evidence reported demonstration as the strategy that involves learners through questions, brainstorming and debates (Achimugu, 2018). Simulation gives students an information-rich environment where they work together, share their ideas in a risk-free but practical environment (Zulfiqar, et al. 2018). Moreover, the advantage is that, it is safe since there are no electric wires or chemicals to be touched. However, the disadvantage of simulation is that it distracts the educator's strategies due to large classes (Billingsley & Scheuermann, 2014; McPherson, Tyler-Wood, Mcenturff, & Peak, 2011). Therefore, if there is chaos in class, effective learning will not occur. Sumarni, (2013) explains that Project-based learning (PBL) is a learning method based on the research, design and everything that engages students' actively. PBL is very good at improving students' academic achievement, motivation, and promote creativity (Sumarni, 2013). Furthermore, Zajkov and Mitrevski (2012) explain that PBL is a learner-centered approach, it does not promote memorization instead, it enhances logical and critical thinking.

Problem-solving is a method that offers training and the ability to solve problems from simple to complex (Aji & Budiyo, 2018). Besides, it is also referred to as a problem-based learning strategy (PBL) (Aji & Budiyo, 2018). Some researchers have reported on case study as a teaching strategy. For instance, it is one of the top methods used in the classroom, it enhances problem-solving skills (Keller, 2016). The case study method is defined as an approach used to assist students to ascertain active results to challenges they encounter concerning real-life situations (Sunbul, 2010). Another strategy that is well known for promoting chalk and talk is the lecture strategy, whereby the educator orally presents facts and ideas to learners, and the teacher is the only one talking (Achimugu, 2018). Literature confirms that the lecture method is a process articulating orally a body of knowledge using the pre-planned scheme (Anaekwe, Nzelum, Olisakwe & Okpala, 2010). The weakness of the lecture strategy is that it does not promote critical thinking; instead, students are passive listeners during the lesson (Achimugu, 2018).

Discussion is the strategy that uses problem-solving skills to manage the learning process and the educator's task is to engage students and let them argue about the task (Aji & Budiyo, 2018). The strategy promotes co-operative learning and independent practice (Saskatchewan Education, 1985, 1991). During discussions, Chingombe (2013) states that learners are free to make some contributions during their learning processes and their opinions are valued. ALshammari (2015) highlights that brainstorming is the strategy that focuses on the activity to introduce new concepts, while AlMutairi (2015) notes that it is a technique that stimulates problem-solving and enhances students' interest. Ode (2014) indicates that brainstorming is advantageous, students can identify and come up with authentic questions to include in learning and involves critical thinking in the process. Abdullahi and Emmanuel (2014) explain that modelling is a strategy whereby the educator demonstrates a new concept and students learn by observing. Modelling plays a vital role in the acquisition and progress of cognitive and meta-cognitive skills, fine motor skills, interpersonal skills and later professional skills (Abdullahi & Emmanuel, 2014). Role-play is a technique used in a different context and in different content areas (Hidayati & Pardijono, 2018). In addition, Akdeniz (2016) clarifies that in role-play, students develop a role model and present the model in class. Furthermore, students can take the character of another person and create a

deeper cognitive link to the material (Hidayati, et al. 2018). Question and answer is a strategy that opens discussions in terms of engaging students in a lesson by posing questions connecting both the prior knowledge and new knowledge. Akdeniz (2016) also remark that questions and answers motivate students to direct appropriate questions to each other. Literature notes that presentation is another strategy that is very important, it equips students with communication skills (Zivkovic, 2014). Girard and Trapp (2011) highlight the strengths of using oral presentations as it encourages class collaboration and increases curiosity in learning. CAPS DBE (2011) states that investigation allows students to do predictions, hypothesis planning, doing investigations, recording information, interpreting information and communicating. According to Hodson (2009), there are four phases in the investigation strategy namely; design and planning phase, performance phase, reflection phase and the recording and reporting phase. Abdullahi and Emmanuel (2014) revealed that modelling is a strategy that exhibits a new concept or approach to learning and students learn by observing. The inquiry is mostly used in subjects that deal with experiments; investigation is a vehicle to get the evidence or proof. Literature notes that inquiry commonly indicates the process of acquiring or obtaining information.

Theoretical Framework

The theoretical framework provides a structure that will guide or support the research paper. The study used Vygotsky's concept of social constructivism. Vygotsky's (1896-1934) social constructivism stresses that social context (the importance of culture and environment on the learning process) is relevant. The theory assumes that reality is constructed through human activity and knowledge is created through interactions with others, and their environment and learning is more meaningful when students are actively engaged. The theory is relevant for the study as it promotes interactive learning and takes into consideration the environment of the learners. Therefore, the strategies are related to the theory as they promote active engagement. Since the study was conducted in deep rural schools, The findings showed that most teachers consider students' environment and actively engage them in in-class activities.

Methodology

Research design

To investigate strategies used by teachers when teaching Natural Sciences, this study employed a descriptive survey design. A questionnaire was used to collect data.

Population, sample and sampling techniques

Thirty out of sixty-seven schools were selected using simple random sampling. This method of sampling was used since it gives everyone the equal opportunity of being selected. The 30 schools are in six out of the eight circuits in the selected education district. Of the 30 schools, each had one Grade 9 Natural Sciences classroom with one teacher per school. Thirty teachers volunteered to participate in the research study.

Research instruments

We designed the data collection instrument, which was a questionnaire with 14 closed-ended questions rated at 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). The questionnaire was designed to measure the strategies that Natural Sciences teachers use to promote science learning. The Cronbach's alpha for the 14 items was 0.936 suggesting that the items had relatively high internal consistency.

Validation and reliability of the research instruments

To ensure validity, the questionnaire was given to two NS Subject Education Specialists (SES) and one science teacher for critic feedback before it was used for data collection. Subject education specialist refers to a person who supports teachers in schools based on their areas of specialisation (Collective agreement 1 of 2008). The study considered the Cronbach alpha test to ensure the reliability of the instrument.

Procedure for data collection

The structured questionnaire was hand-delivered to 30 science teachers who were requested to complete the task within seven days. After seven days, only 16 had completed. Those who were not ready for submissions were given four more days to respond to the questionnaire which was later collected by the researchers.

Data analysis

Both descriptive and inferential statistics were employed in the analysis of the collected data. Two research questions were answered using frequency counts and percentages. The teaching methods that have Natural Sciences teachers' percentage responses of 50% and above are grouped as 'most used' and the teaching methods for which the percentage is below 50% are grouped as 'least used'.

Results

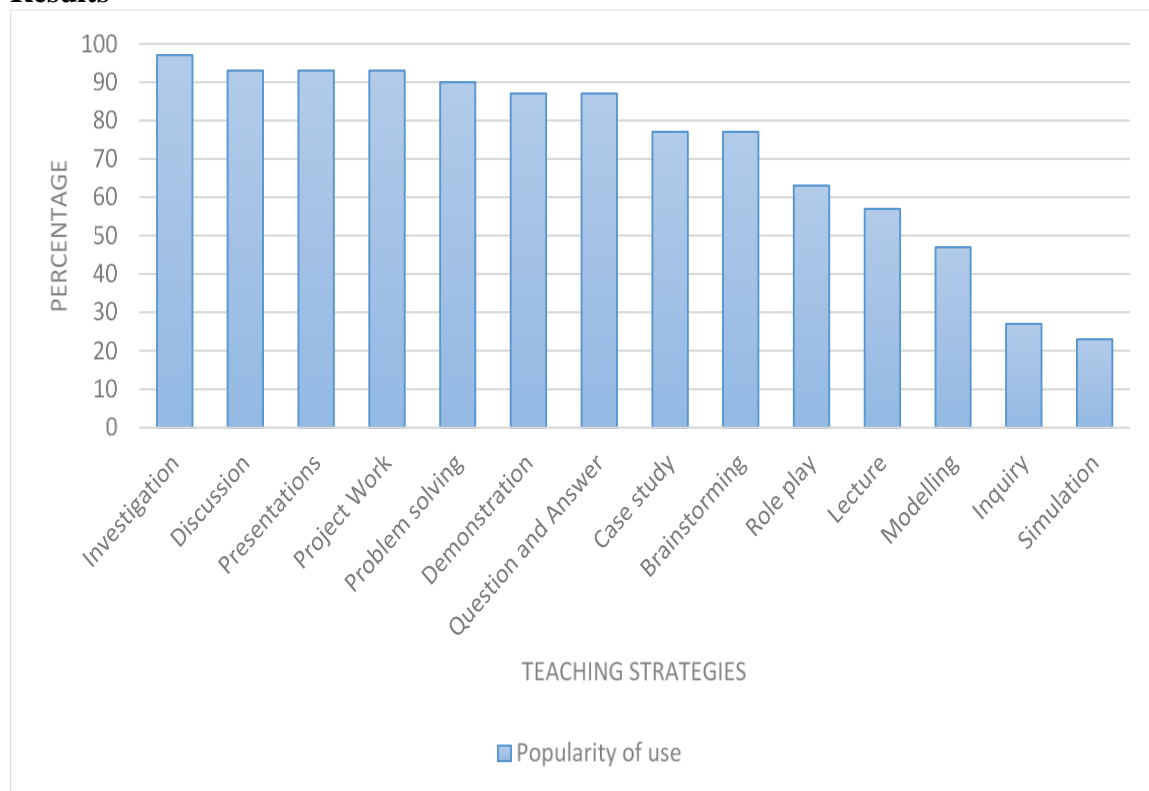


Figure1: Natural Sciences (NS) teachers' various teaching methods

Figure 1 shows the strategies mostly used and less used by teachers to teach the Natural Sciences curriculum in descending order as follows:

Investigation 97% (n=29); Discussion, Presentation and Project 93% (n=28); Problem solving 90% (n=27); Demonstration and Question and Answer obtained responses of up to 87% (n=26); Case study and Brainstorming the responses were up to 77% (n=23); Role-play 63% (n=20); Lecture 57% (n=18); Modelling 47% (n=15); Inquiry 27% (n=9); Simulation 23% (n=7).

(19) and Lecture 57% (17). The strategies least used by NS teachers to teach natural science curriculum were Modelling 47% (n=14), Inquiry 27% (n=8), and Simulation 23% (n=7).

Discussion of findings

Data indicates that investigation is the strategy mostly used by Natural Sciences teachers. Literature confirms that investigation allows students to do predictions, hypotheses, planning investigations, doing investigations, recording information, interpreting information and communicating to come up with the evidence (DBE, 2011). Hodson (2009) concurs with the above author and further explains that to conduct the investigation; four phases need to be followed, that is, planning, reflection and a recording and reporting phase. To be successfully implemented investigation needs resources, Mtsi and Maphosa (2016) state that resources need to be available to enable proper teaching of science.

Discussion, presentation and project are among the most used strategies. Previous studies highlight that discussion is the strategy that uses problem-solving skills to accomplish the learning process and actively engages students (Aji & Budiyono, 2018). Presentations equip students with communication skills, encourage class collaboration, boost confidence and motivate students for public speaking (Girard & Trapp, 2011; Zivkovic, 2014). Project is also called project-based learning (PBL), it emphasizes a learner-centred approach and does not promote memorization (Zajkov & Mitrevski, 2012). Sumarni, (2013) explains that the strategy is a learning process based on research.

Demonstration is a strategy whereby the educator is the leading actor and students watch to participate later through questioning, brainstorming and debating (Ekeyi, 2013; Achimugu, 2018). For question and answer strategy, Akdeniz (2016) notes that the teacher employs this strategy by posing questions to students to connect the concepts to the topic and students direct questions to each other. The present researchers believe that question and answer strategy can confuse the students if it is not well structured, for example, students must be given optimum time to think soon after the question has been posed. The case study is among the strategies that enhance problem-solving skills and assist students to discover active results in challenges related to real-life situations (Sunbul, 2010; Keller, 2016). Although the case study has positives, Sunbul (2010) reports that one of the challenges with the strategy is that it may be difficult to implement due to limited time. ALshammari (2015) and AIMutairi (2015) aver that brainstorming is the strategy that focuses on the activity to introduce new concepts and it also stimulates problem-solving and attracts students' curiosity. We argue that brainstorming invites students on board to develop the drive to participate in the lesson. The challenge identified is that, when large classes are not monitored, this can lead to opinions that inhibit teaching and learning.

Role-play and lecture are also used by teachers. Role-play encourages creativity and promote team work. When students take the role of another person, confidence is developed and creates a deeper cognitive link to the material (Akdeniz, 2016; Hidayati, et al. 2018). For instance, students can imitate their teacher during discussions or presentations. The weakness is that it can degenerate into chaos if it is not monitored. The lecture strategy is the strategy that is seemingly unpopular. Previous studies note that the lecture strategy is well known for promoting chalk and talk, moreover and expressing orally a body of knowledge (Achimugu, 2018; Anaekwe, Nzelum, Olisakwe & Okpala, 2010). Though the lecturer strategy is not popular, in science, some concepts need clarity in terms of explaining to students and giving them information. For example, Sunbul (2010) reports that sometimes due to different challenges, it may be difficult to implement the method. Therefore, the lecture method needs

to be considered as an important strategy when accompanied by interactive learning strategies. The strategies least used by NS teachers to teach the natural science curriculum were modelling, inquiry, and simulation. The weakness is that educators' poor teaching practices may be destructive especially in large classes (Billingsley & Scheuermann, 2014; McPherson, Tyler-Wood, Mcenturff, & Peak, 2011). The present researchers are of the view that, although the strategy is good, students will lose concentration and focus on watching images instead of listening to the content.

Conclusion

The study confirmed that Natural Sciences teachers were using both micro and macro strategies successfully, and they recognised that these teaching strategies included active engagement, metacognition, higher-order thinking, co-operative learning and independent practice. The most used strategies by educators were investigation; discussion, presentation, project, problem solving, demonstration, question-answer, case study, brainstorming, role-play, lecture. The least used were modelling, inquiry and simulation.

Recommendations

Teachers need to apply these strategies in their classes. Moreover, they need to work as a team by sharing ideas with other teachers who are conversant with instructional strategies.

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MOTIVATION AND SELF-EFFICACY AS CORRELATES OF SECONDARY SCHOOL PHYSICS STUDENTS' ACADEMIC ACHIEVEMENT IN BENUE STATE, NIGERIA

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Abstract

Research has shown that motivation and self-efficacy are related to students' achievement in academic activities in school. Studies have been conducted with the view of remedying the poor performance of students in physics but not all have been successful. However, such studies focused mainly on the cognitive aspect of students with little attention to the psychological variables. This study, therefore, determined how motivation and self-efficacy correlate with secondary school physics students' academic achievement. Correlational research design was adopted for the study using a sample of 210 senior secondary one physics students in Benue State, Nigeria. Data collection was achieved using the motivation scale and self-efficacy scale. Correlation statistics and analysis of variance were used to analyse the data. Results showed that motivation and self-efficacy significantly correlated positively with the students' academic achievement in physics. This implies that low motivation and self-efficacy of students will result in low academic achievement in physics and vice versa. It was recommended that favourable academic environment should be provided for the learners to promote their motivation and self-efficacy.

Keywords: *Correlation, Motivation, Physics, Students' academic achievement, Self-efficacy*

Introduction

Students' performance in physics examinations in Nigeria has been below expectations for several years now (Ugwuanyi et al., 2020a; Ugwuanyi & Okeke, 2020). Ugwuanyi et al. (2020b) found that students' achievement and retention in physics have been on the decline in Nigeria. Similarly, Gana et al. (2020) noted that students' performance in physics concepts over a decade now has been poor. The present researchers observed that earlier research in Nigeria traced learners' poor achievement to teachers' specific factors such as psychological factors. Despite this, most research in physics education focused more on the cognitive aspect of the students than their psychological factors. According to Antonio, Maria-Victoria and Paola-Veronica (2017), self-efficacy and motivation, among others, are all factors that need to be extensively evaluated in the academic context. However, most of these factors have not been properly researched especially how they relate to academic achievement (Antonio, Maria-Victoria & Paola-Veronica, 2017).

According to Schumacher and Ifenthaler (2018), motivation is the driver of a person's actions. Schunk et al. (2008) defined motivation as the process of instigating and sustaining goal-directed activity. According to Cook and Artino Jr (2016), motivation results from the interaction between environmental and individual factors. Based on the foregoing, Bandura (1977) as well as Zimmerman et al. (2017) submitted that both internal and external factors such as self-efficacy influence a person's motivation. Bandura (1977) defined self-efficacy as individuals' beliefs which concern their judgments and capabilities in order to reach designated goals through organised actions. Individuals who have a high level of self-efficacy are more confident in executing difficult tasks that they encounter (Kapucu, 2017). In line with the above views, the present researchers explored how motivation and self-efficacy

relate to students' achievement in physics within the theoretical frameworks of B.F Skinner and A. Bandura.

Theoretical background of the study

Theoretically, this study was anchored on Skinner's (1938) operant conditioning theory and Bandura's (1977) social cognitive theory. Skinner (1938) believed that reinforced behaviour repeats itself while the reverse becomes the case. This theory implies that adequate motivation of students produces high achievement. On the other hand, Bandura's SCT states that people learn new behaviour from the observation of a model performing a behaviour. This implies that behavioural change depends on a person's perceived self-efficacy.

Review of related empirical studies

Mohammad (2017) found that motivation correlates positively with students' reading comprehension. Achufusi et al. (2019) found that students' achievement significantly depends on motivation. Wenty and Slamet (2019) found that self-motivation relates positively with the achievement of students in biology. The learning achievement of the students of biology education significantly depends on their intrinsic and extrinsic motivation (Tokan & Imakulata, 2019). Taştan et al. (2018) reported that academic achievement in science education significantly correlates with teacher's motivation. According to Metriana as cited in Tokan and Imakulata (2019), motivation and self-efficacy had a significant positive correlation with achievement.

van Rooij, Jansen and Van de Grift (2017) revealed that students' cognition and academic interest relate positively to self-efficacy. Physics self-efficacy correlates positively with students' mathematics achievement as well as physics achievement (Kapucu, 2017). Rahman et al. (2019) revealed that teachers' self-efficacy significantly correlates positively with academic achievement. Ozkal (2019) found that self-efficacy beliefs in learning determine the achievement of students in mathematics. Suprayogi, Ratriana and Wulandari (2019) found that academic efficacy had a significant relationship with academic achievement. Taştan et al. (2018) reported that teachers' self-efficacy significantly relates to science education students' academic achievement.

The foregoing shows that a lot of studies have been conducted on the relationship among motivation, self-efficacy, and students' academic achievement. Careful examination of the findings of those studies showed that there are a lot of inconsistencies in the findings of the studies. However, most of the studies were conducted in other countries other than Nigeria. Thus, these researchers deemed it necessary to carry out this research within the Nigerian context using secondary school learners in Benue state.

Objectives of the Study

The study sought to determine the:

1. Correlation between motivation and physics students' academic achievement.
2. Correlation between self-efficacy and physics students' academic achievement.

Research questions

1. What is the correlation between motivation and physics students' academic achievement?
2. What is the correlation between self-efficacy and physics students' academic achievement?

Hypotheses

H₀₁: There is no significant correlation between motivation and physics students' academic achievement.

H₀₂: There is no significant correlation between self-efficacy and physics students' academic achievement.

Methods

Research Design

Correlational survey research design was used for this study. This type of study establishes the relationship that exists between variables. In similar studies, Gana, Ugwuanyi and Ageda (2019), Gana et al. (2020), Ugwuanyi, Okeke and Ageda (2020), Ugwuanyi, Okeke and Njeze (2020) and Ugwuanyi et al. (2020c), have used this design.

Participants

A sample of 210 senior secondary I (SS I) Physics students formed the participants for the study. This sample was drawn from a public secondary school population of 8,652 SS I Physics students in education Zone B of Benue State, Nigeria. The sample was composed through a multi-stage sampling procedure starting with the selection of four local government areas using a simple random sampling technique by balloting at the first stage. Fifteen secondary schools were sample out of the 64 public secondary schools using a disproportionate stratified random sampling technique. Finally, using a disproportionate stratified random sampling technique, 14 SS I physics students were sampled from each of the 15 senior secondary schools totaling 210 students.

Instrumentation and Procedure

The data for this study were collected using the Motivation Scale (MS) and Self-efficacy scale (SES). The researchers' motivation scale is a 20-item statement to elicit responses from the students on their level of motivation to learn. The self-efficacy scale as developed by the researchers is a 15-item statement to elicit responses pertaining to students' self-efficacy. The items of both MS and SES were modeled on a 4-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

Students' academic achievement in physics were requested from the head of physics of the various schools used for the study. Copies of the first and second terms' results of the students who participated in the study were made available to the researchers for the sole purpose of the research. This enabled the researchers to extract the scores of the participants while the average of the scores served as the achievement score of each of the students.

Instruments Validation

To ensure the face validity of the MS and SES, the instruments were presented to three experts in instrument development. The experts looked at the clarity of items, simplicity of vocabulary, and relevance of items of the instruments to the research objectives. Based on the observations and corrections of these experts, the instruments were modified accordingly. Copies of the validated instruments were trial tested on 20 students outside the study area to establish the reliability of the items of the instruments. The reliability indices obtained for the MS and SES using Cronbach alpha were 0.83 and 0.77 respectively.

Finally, copies of the instruments were administered to the selected schools through visitation to the sampled schools by the researchers with the help of research assistants. The copies of the instruments were retrieved from the participants after completion.

Ethical Measures

The ethical approval to conduct this research was granted by the Research Ethical Committee of the Faculty of Education, University of Nigeria.

Data Analyses

Simple linear regression analysis was used to answer research questions and test the null hypotheses. The null hypotheses were tested at 5 percent probability level.

Results

H₀₁: There is no significant correlation between motivation and physics students' academic achievement.

Table 1: Regression analysis of the correlation between motivation and physics students' academic achievement

1.	2.	3.	4.	5.	6.	7.	8.
r	r	Squared	Standard error of the	Estimate	F	f	
		.42	1.43		8		
	65				6.42	14	00

a. Predictors: (Constant), Motivation

Table 1 shows that motivation had a significant high correlation ($r = 0.65$) with physics students' academic achievement with a coefficient of determination of 0.42, $F(1, 214) = 86.42$, $p < .05$. This indicates that 42% of the students' academic achievement in physics is attributed to motivation. Thus, the null hypothesis was rejected at $p = .00$.

H₀₂: There is no significant correlation between self-efficacy and physics students' academic achievement.

Table 2: Regression analysis of the correlation between self-efficacy and physics students' academic achievement

16.	17.	18.	19.	20.	21.	22.	23.
r	r	Squared	Standard error of the	Estimate	F	f	
		.58	2.81		8		
	76				7.91	14	00

a. Predictors: (Constant), Self-efficacy

Table 2 shows that self-efficacy had a significant high positive correlation ($r = 0.76$) on physics students' academic achievement, with a coefficient of determination of 0.58, $F(1, 214) = 87.91$, $p < .05$. This indicates that 58% of the students' academic achievement in physics is attributed to self-efficacy. Thus, the null hypothesis was rejected at $p = .00$.

Discussions

This study empirically determined how motivation and self-efficacy correlate with learners' achievement in physics. The outcome of the regression analysis showed that motivation and self-efficacy had significant high positive correlation on learner's achievement in physics. These findings have strengthened the theoretical basis of operant conditioning theory by B.F Skinner and social cognitive theory by A. Bandura. From theoretical basis of Skinner, the effective motivation of learners produces a positive outcome of the learners on a particular task. In the same vein, social learning theory shows that behavioural change depends on a person's perceived self-efficacy. These findings are in tandem with the findings of previous studies such as Achufusi, Utakaj, Onuh and Okonkwoe (2019); Tokan and Imakulata (2019); Metriana as cited in Tokan and Imakulata (2019); Wenty and Slamet (2019); Taştan et al. (2018); Caroline (2017); Akam (2014); Ozkal (2019); van Rooij, Jansen and van de Grift (2017); Rahman, Ghaffar, Hamid and Thomas (2019).

Achufusi et al. (2019) found that students' achievement significantly depends on motivation. Wenty and Slamet (2019) found that self-motivation relates positively with the achievement of students in biology. The learning achievement of the biology education students significantly depends on their intrinsic and extrinsic motivation (Tokan & Imakulata, 2019). Taştan et al. (2018) reported that academic achievement in science education significantly correlates with teacher's motivation. According to Metriana as cited in Tokan and Imakulata (2019), motivation and self-efficacy had a significant positive correlation with achievement.

Van Rooij, Jansen and van de Grift (2017) revealed that students' cognition and academic interest relate positively to self-efficacy. Physics' self-efficacy relates positively to students' mathematics achievement as well as physics achievement (Kapucu, 2017). Rahman et al. (2019) revealed that teachers' self-efficacy significantly correlates positively with academic goal achievement. Ozkal (2019) found that self-efficacy beliefs in learning determine the achievement of students in mathematics. Suprayogi, Ratriana and Wulandari (2019) found that academic efficacy had a significant relationship with academic achievement. Taştan et al. (2018) reported that teachers' self-efficacy significantly relates to the academic achievement of students in science education. This current study has been able to determine the correlation of motivation and self-efficacy with learners' achievement in physics using secondary school students in Benue State as participants. The study has contributed to the body of knowledge by empirically determining the how motivation and self-efficacy correlate with learners' achievement in physics. This will help physics educators in designing appropriate physics instructions that will motivate the learners and increase their self-efficacy in order to enhance their academic achievement.

Limitations

This study considered only participants from a particular cultural orientation. Thus, determining the moderating influence of cultural orientation on the correlation of motivation and self-efficacy with learners' achievement was not possible. This may have limited the generalizability of the findings to learners of different cultural orientation. Also, non-inclusion of the gender and school location as possible moderators may limit the generalizability of the findings. On this basis, the researchers suggest that future researchers should consider the moderating influences of cultural orientation, gender, and school location on the impacts of motivation and self-efficacy on learners' achievement in physics.

Conclusion

Motivation and self-efficacy of learners have significant correlation with learners' achievement in physics. In other words, high motivation and self-efficacy lead to high learners' achievement in physics. Thus, motivation and self-efficacy of learners should not be looked down on in order to achieve an enhanced learners' achievement in physics.

Recommendations

On the basis of the findings of this study, the researchers made the following recommendations.

1. A conducive environment that will promote the motivation of students, as well as their self-efficacy, should be maintained in the schools.
2. Physics teachers should adopt the best instructional strategies that will motivate and increase the self-efficacy of the learners in order to have improved academic achievement of the learners.

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TESTING AND VALIDATION OF THE FIRST IMPLEMENTATION OF THE GO-LAB OPEN ACCESS DIGITAL ECOSYSTEM FOR INQUIRY LEARNING IN AFRICA

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Abstract

This paper presents the results of the testing and validation activities of the first adaptation of the Go-Lab open access digital ecosystem for inquiry learning in Africa supported by GO-GA (Go-Lab Goes Africa), an ongoing action aimed at promoting and implementing digital STEM education at schools in Africa. Following the adaptation of the Go-Lab ecosystem to the educational context of the partner countries (Kenya, Nigeria, and the Republic of Benin) during the first year of the project, we describe the methods used for testing and validation, analyse the collected data and present the results. The results highlighted the need to expand the resources suitable for the national curricula of the pilot countries are, and to make the access to these resources more visible. Furthermore, the results indicated that first-time users tend to use the links in the subpages and side menus to navigate the ecosystem, rather than explore the ecosystem systematically using the main menu pages. Additional results in relation to technical observations, interaction with the ecosystem and users' feedback are presented in this paper. We further highlight the improvements introduced in the Go-Lab ecosystem which were driven by the testing and validation sessions, and we provide guidelines and suggestions to strengthen adoption and dissemination, such as implementing performance improvement techniques, creating an offline version of the ecosystem, as well as providing suggestions for the teacher training activities.

Keywords: *active learning; collaborative learning; digital education; GO-GA; Go-Lab; inquiry-based learning; STEM education*

Introduction

Go-Lab Goes Africa (GO-GA) is an innovation action focused on implementing digital education for Science, Technology, Engineering and Mathematics (STEM) in Africa. It is supported by the European Commission (EC) through its H2020 Framework Programme for Research and Technological Development in Information and Communication Technologies (ICT). GO-GA aims at accelerating the creation of rich learning environments and improving learning outcomes in science and technology through the deployment of digital STEM content and capacity development of teachers in three partner countries—Kenya, Nigeria, and the Republic of Benin—and further in four associate countries—Ghana, Senegal, Sierra Leone and Uganda. The project is aligned with the 2030 Global Education Goal of UNESCO's programme *Education for All (Education for All Movement, 2013; Leicht et al.,*

2018), by focusing on the implementation of specific forms of digital education at secondary schools, such as Inquiry-based Learning (IBL) and competence-based education.

The Go-Lab ecosystem was mainly developed under the Go-Lab and Next-Lab European projects, supported by the EC's Seventh and H2020 Framework Programmes, respectively. As such, it has been implemented mainly in European schools, whose educational context is not necessarily the same as that of the targeted African context.

This paper describes the methodology for the testing and validation of the adapted and localized Go-Lab ecosystem in three pilot countries (Kenya, Nigeria, and the Republic of Benin); provides detailed information about the techniques used to collect data; presents the data analysis, an evaluation of the results, and a summary of the findings; and finally concludes with recommendations for further improvements of the Go-Lab ecosystem for Africa.

Conceptual framework

Inquiry-Based Learning and Online Labs

Active learning is a very effective learner-centred approach for science education, in which students participate in the learning process, by actually doing something more than listening and thinking. Of all the active learning methods and approaches, inquiry-based learning (IBL, Pedaste et al., 2015) with online (mostly virtual) laboratories is one of the most successful (de Jong et al., 2013). There are several advantages for using non-traditional online laboratories over hands-on labs. On the one hand, students feel more comfortable executing the experiments because they are not afraid to fail, the labs are cheaper and have less environmental impact (tools do not break apart and there is no waste), they are more easily accessible, and they offer the possibility of augmented reality. On the other hand, there is strong empirical evidence for the learning outcome achievement using virtual labs being at least the same as the one using traditional laboratories in fundamental categories, such as knowledge and understanding, inquiry skills, perception, analytical skills, and social and scientific communication (Brinson, 2015).

The Go-Lab ecosystem was developed in order to provide learners with a digital environment supporting inquiry learning with online laboratories and including multimedia resources and apps. The ecosystem is composed of the Go-Lab sharing and support platform Golabz at <https://www.golabz.eu/>, which provides access to a large and unique collection of online laboratories and scientific data sets from worldwide repositories, such as PhET, Amrita, and ChemCollective, from universities, institutions, and renowned research organisations, such as the European Space Agency (ESA), the European Organisation for Nuclear Research (CERN), and the Astronomical Observatory of Coimbra's University (OGA). Additionally, the platform includes learning applications (apps) supporting inquiry and collaborative learning, assessment, and the use of learning analytics. The "Hypothesis Scratchpad" and the "Experiment Design Tool" are examples of inquiry applications, where students can formulate their hypotheses and design their experiments in the learning environment, this way being supported in their inquiry process (Zacharia et al., 2015). Using the Go-Lab authoring and learning platform Graasp at <https://graasp.eu/>, teachers can combine online laboratories, learning apps, and multimedia content into a rich and structured open educational resource (OER), referred hereafter as an Inquiry Learning Space (ILS), which they can then share with their students. The ecosystem supports all inquiry stages in a flexible way, it promotes collaboration and interdisciplinarity, and thus facilitates the development of activities that allow students to explore real-world challenges.

This action is in line with the priorities defined by EC and STISA-2024, by contributing to the implementation of IBL in the classroom with the help of digital tools, such as the online laboratories and apps provided by the ecosystem. By promoting teacher training programmes, focusing on the use of online applications and laboratories, and digital platforms in the classroom, GO-GA allows for the development of digital competences in both learners and teachers. It also facilitates the transformation into a digital school with the help of a roadmap that focuses on the ICT curriculum and infrastructure, professional development, leadership and planning, and technology enhanced learning culture.

Usability testing approaches

The adaptation and localization of the Go-Lab ecosystem, its content and the teacher training are at the heart of the GO-GA action. The former requires an initial study of the pedagogical and technical constraints, the elicitation of requirements (identification of the technical and pedagogical needs of the users) and, finally, the testing and validation of the ecosystem. In that regard, usability evaluation methods are widely recognized as effective ways to assess the usefulness of a product or software (Rosenzweig, 2015). Generally, there are three types of usability evaluation methods: inspection, testing, and inquiry (Hom, 1998; Rubin & Chisnell, 2008).

In the usability inspection approach, usability-related aspects of a user interface are examined. Of the inspection methods, task or action analysis emerges as an effective way to gather a deep insight into user's performance when completing a task, since action sequences performed by users are monitored throughout the inspection (Nielsen, 1994). It has the advantage, over other inspection methods, such as heuristic evaluation or cognitive walkthrough, of involving the end users in the process. However, it is time-consuming (Cheng & Mustafa, 2015).

In the usability testing approach, representative users work on typical assignments using the system, and the results are used to assess how the interface supports the users to carry out their tasks. This approach comprises, for instance, the coaching and co-discovery methods, and the thinking aloud protocol. In the coaching method, users are allowed to ask any questions during the execution of the tasks, while in the co-discovery method, users work in small groups to attempt to perform the assigned tasks. In both cases, the users are observed while exploring the platform or executing a specific task. In the thinking aloud protocol, users are invited to verbalize their thoughts, feelings and opinions while interacting with the system (Lewis, 1982).

Inquiry¹ can be typically carried out by means of field observation, focus groups, interviews or questionnaires. In a field observation, users are observed and inquired directly in their work places; in focus groups, small teams of users are brought together to discuss issues relating to the system; in interviews and questionnaires, questions are asked to the users in order to gather relevant information.

Several of these methods were applied during the testing and validation of the first adaptation of the Go-Lab ecosystem, in the form of workshops, activities and scenarios, task analysis, observation forms, open discussions and brainstorming, questionnaires, and video recordings together with the thinking-aloud protocol. They will be discussed in the following sections.

¹ Not to be confused with inquiry-based learning (IBL).

Context of the study

The aim of the testing and validation study was to evaluate the release of the first set of requirements, including the added languages and translations interfaces, as well as the resources specific to each country. Additionally, the performance of the ecosystem with the available technical infrastructure and the usability of its platforms (Golabz and Graasp) were tested to elicit further improvement and development. The following research questions guided the study:

1. How do first-time users freely navigate the Go-Lab ecosystem?
2. How do first-time users find specific resources in the Go-Lab ecosystem?
3. Is the quality of the implemented automated translation in French good enough to support users navigate the ecosystem?
4. What technical issues emerge while using the Go-Lab platforms with the available infrastructure in the pilot countries?
5. How can the functions and features most valued by the users be further developed and improved?

Methods

In GO-GA, the professional development of the teachers, the creation of digital educational content, the use of the IBL methodology and of virtual online laboratories in the classroom are supported by the Go-Lab ecosystem. A set of online labs and ILSs selected to fit the curricula of Kenya, Nigeria, and the Republic of Benin were compiled in the *Collections* page of the platform (see fig. 1). The Collections page was at the heart of the task of adapting and localizing the ecosystem to the participating countries.

The screenshot shows the 'Collections' page on the Go-Lab platform. The page features a navigation bar with links for Labs, Apps, Spaces, Authoring, Support, Premium, About, and News. The main content area displays a list of educational resources, each with a title, a brief description, and a thumbnail image. The resources include:

- Quadratic Equations**: Kenyan ILS On Quadratic Equation Form Three Mathematics. Includes a thumbnail showing a graph of a parabola.
- Conversion De L'énergie Électrique En Énergie Thermique**: L'objectif de cet espace d'apprentissage est d'étudier la loi de Joule dans un conducteur ohmique en s'appuyant sur le calcul de l'énergie électrique consommée et sur le calcul de la chaleur reçue par l'eau contenue dans un récipient et dans laquelle plonge le conducteur ohmique. Includes a thumbnail showing a circuit diagram.
- Les Mutations Génétiques**: Cet ILS vise à aider les apprenants à apprendre : - ce que signifie véritablement une mutation, - quelles sont les différents types de mutation, - quelles sont les conséquences d'une mutation. Includes a thumbnail showing a DNA double helix structure.
- Curved Mirrors**: This ILS is used in the Form 2 (grade 10) Kenyan curriculum. The learners at this stage have already... Includes a thumbnail showing a curved mirror.

On the right side of the page, there are several filter panels:

- Resource types**: Inquiry Learning Spaces (20), Online Labs (58)
- Country**: Benin (18), Kenya (42), Nigeria (31)
- Subject Domains**: Biology (15), Chemistry (21), Engineering (2), Environmental Education (6), Geography And Earth Science (1), Mathematics (9), Physics (36), Technology (2)
- Age Ranges**: Before 7 (1), 7-8 (4), 9-10 (20), 11-12 (23), 13-14 (60), 15-16 (63), Above 16 (42)

Figure 1: The Collections page in golabz.eu, a page where selected educational contents have been adapted to the curricula of Kenya, Nigeria, and the Republic of Benin.

The test and validation of the first release of the adapted and localized ecosystem were carried out during three-day intensive Train-the-Trainer (TtT) workshops in Nigeria and Kenya, and during a specific training and testing event in the Republic of Benin focusing on validating the Go-Lab ecosystem with new users. Qualitative and quantitative data were collected throughout the events by means of observation forms and questionnaires, activities, open discussions, video recordings, and the use of scenarios (see tab. 1).

The video recordings allowed the analysis of how first-time users explored the ecosystem: which pages they visited, which menus and functions they used, how they searched for content, and whether they faced any technical or non-technical issues. Teachers were invited to think-aloud while they were working. Thirteen videos were saved and analysed, totalling 405 minutes of recording, corresponding to an average recording time of 31 minutes per participant.

In the Republic of Benin, two scenarios were provided to the teachers before they were introduced to the Go-Lab ecosystem and trained to use it. The scenarios aimed at studying the first-time users' preferred navigation style(s) and search method(s) using the ecosystem, the level of difficulty in finding specific content, at collecting feedback on the quality of the automated French text translation of the main text and descriptions of labs and apps, and at introducing teachers to the different resources available.

The observation forms included items related to internet connectivity and technical feedback. They were filled in by team members while participants were completing the hands-on tasks and working with the Go-Lab ecosystem. The aim was to test if teachers were using the features previously released, to discern the challenges they faced while working with the ecosystem, and to make better-informed decisions for future developments and activities.

At the end of each event, teachers were asked to fill in a questionnaire using an online form. The questionnaire consisted of 17 items in all. Overall, 79 teachers participated in the process: 24 from Kenya, 35 from Nigeria, and 20 from the Republic of Benin. They were either master teachers (MTs) selected for the TtT programme (in Kenya and Nigeria) or new teachers specially selected for the testing and validation event in Benin. In both cases, the general ICT level of the participants was considered fair. The questionnaires were aimed at collecting the participants' perceptions and opinions on working with the Go-Lab ecosystem, as well as their feedback concerning any technical and navigational difficulties they may have faced. A five-point Likert scale, ranging from 1 ("Strongly Agree") to 5 ("Strongly Disagree"), was used and, whenever applicable, the option "I don't know, I haven't used this feature" was added. Seventy-three responses were submitted, of which 31.5% were from Kenya (95.8% of Kenyan participants), 43.8% from Nigeria (91.4% of Nigerian participants), and 24.7% from Benin (90% of Beninese participants).

Users' feedback concentrated on technical aspects and challenges, and teachers' experiences about working with the Go-Lab ecosystem. It was collected in all events, by means of open discussions, creation of group charts listing the benefits and challenges of using the ecosystem, and affinity diagrams. The latter was promoted in all sessions, as it is an effective way of organizing ideas, identifying problems and finding solutions (Britz, 2010). The feedback was documented, put together and categorized to identify common issues. However, due to space limitations, its analysis will not be covered in this paper.

Table 1: Overview of the methods used to collect the data during the testing and validation sessions.

	Kenya	Nigeria	The Republic of Benin
Video recordings			x
Scenarios			x
Observation form	X	X	x
Questionnaire	X	X	x
Participants' feedback	X	X	x

Data Analysis

The data were analysed according to three categories: Usability testing — analysis of the scenarios and video recording for the first-time users in the Republic of Benin; Questionnaires' results; and Participants' feedback.

Two scenarios consisting of simple tasks were proposed to the Beninese teachers before they were introduced to the Go-Lab ecosystem: in scenario A, teachers had to find a specific lab in Golabz, while in scenario B they had to write down the names of apps that would allow achieving a specified goal. In both scenarios, teachers were requested to give feedback on the difficulty of the requested task. The scenarios provided insights on how first-time users navigated through the platform and how they searched for specific content. The responses were collected in a form and subsequently analysed.

The video recordings were analysed according to a coding scheme underpinned by the following categories: cookies notification acceptance, change of language (yes/no, how and when), home page usage, main menu and corresponding submenus usage, subpages and functions exploration, search methods (with a focus on the in-context menu), internet connection and technical issues (quality of internet access and platform specific errors), browser used, video duration, and thumbnails utilisation. The video recordings allowed to (i) understand how teachers navigated through the Golabz.eu landing page, (ii) check if they accepted the cookies notification, (iii) verify if they used the translated version of the page (see fig. 3), (iv) find out how often teachers accessed the pages of the main menu (Labs, Apps, Spaces, Authoring, Support, News, About, and Collections; see fig. 4), (v) verify the search methods they used throughout their exploration (see fig. 5), (vi) identify which browser they were using, (vii) assess the quality of the internet connection (typically slow), and (viii) enumerate and tackle (a posteriori) platform errors.

The questionnaires were filled in by the teachers at the end of the events. They allowed to gather in depth knowledge about the use of the ecosystem, specifically on how comfortable teachers felt in navigating the ecosystem, how useful were the available filters, the search function and the Collections page, how easy it was to create an ILS from a lab in Golabz.eu or from the Graasp.eu authoring platform, and if teachers managed to publish one ILS (if teachers are willing to share the resources they have created and used in class with other teachers, they can publish them under creative commons licenses on golabz.eu). In addition, they allowed to assess technical difficulties teachers were facing when exploring the ecosystem. Thirteen questionnaires were collected and analysed.

Results

Scenarios: Most of the teachers found the automatic French translation clear enough, they used the in-context filters to search for a specific lab, and they considered the scenarios somehow difficult to execute. The results are compiled in fig. 2

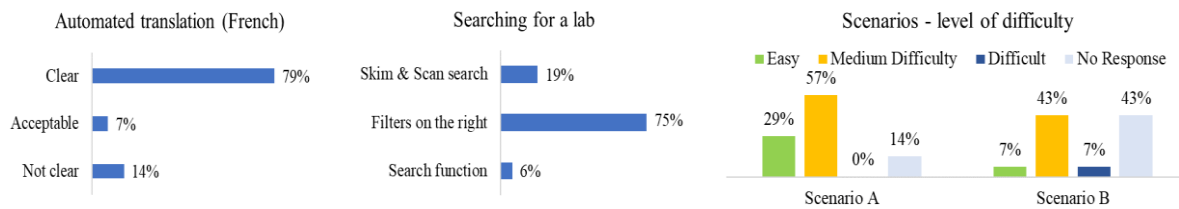


Figure 2: Teachers' feedback on the quality of the automated translation into French (*left*), on how they searched for specific contents (*centre*), and on the difficulty level of the scenarios (*right*).

Video recordings: Teachers used their own laptops during the sessions, and most of them (9 out of 13, *i.e.*, 69%) did not accept the cookies. Firefox was used by 61.5% of the teachers, Chrome by 30.8%, and Chromium by 7.7% of the participants. Most of the software (including operating systems) was outdated, which brought additional difficulties in navigating the ecosystem and in having access to its full content. The details of the outcomes of the analysis of the videos are highlighted in figs. 3 to 5.

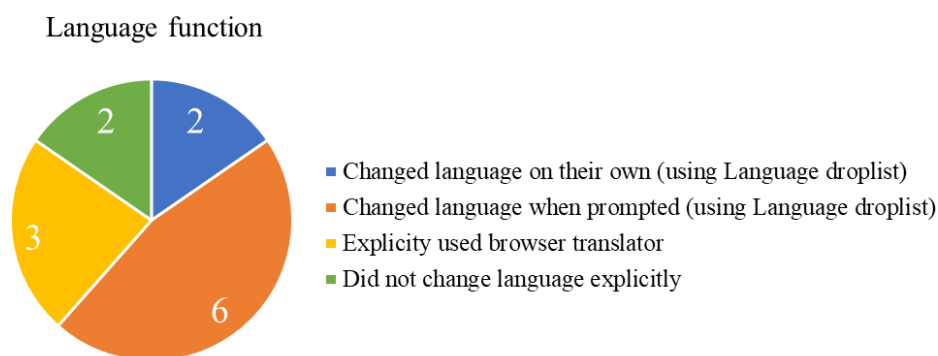


Figure 3: Number of users per language selection option (French) in the Golabz platform: 15.4% changed the language on their own, 46.2% changed the language when prompted, 23% explicitly used a browser translator tool, and 15.4% did not change the language at all.

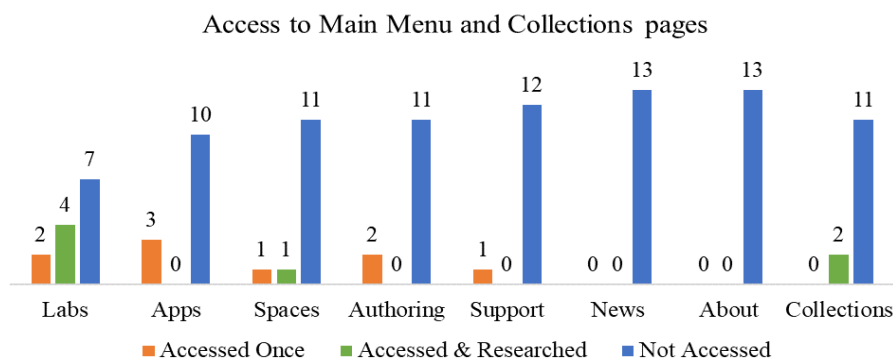


Figure 4: Number of users per type of access in each of the indicated subpages of Golabz. The most accessed pages were the Labs and the Apps. The News and About tabs were never accessed, and the Collections page was accessed and researched by only two teachers.

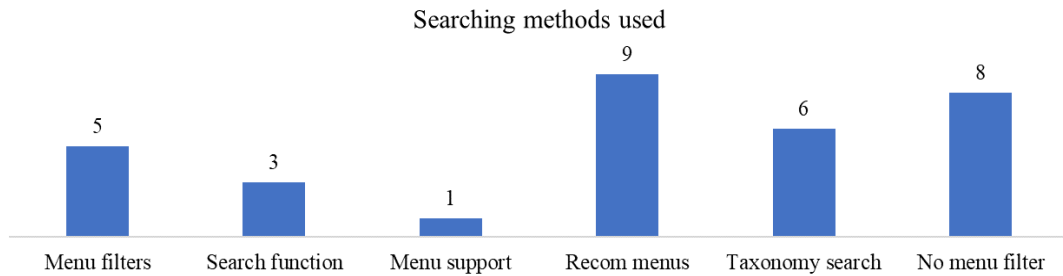


Figure 5: Number of users per searching method.

From left to right, the columns stand for *In-context menu and filters* (Golabz main pages), *Search function* (Golabz), *In-context menu* (support page), *Recommendation & Used in...* (Labs & Apps subpages), *Meta data in description subpages* (taxonomy search), and *Did not use any menu or filter* (skim and scan), respectively. The “Recommendation”, “Used in...” and skimming and scanning method were the most used strategies for finding content.

Questionnaire: From the 17 items in the questionnaire, we focus on the users’ personal feedback regarding what they value the most in the ecosystem and the changes they would like to see. Overall, the resources, the educative value and the interactivity, engagement and motivation for the learners were the most appreciated features. The most requested changes were related to the offline availability of educational content and the need for more resources related to the local curricula. However, a considerable number of teachers—especially in the Republic of Benin—were happy with the current state of the ecosystem. The overall results are highlighted in figs. 6 and 7.

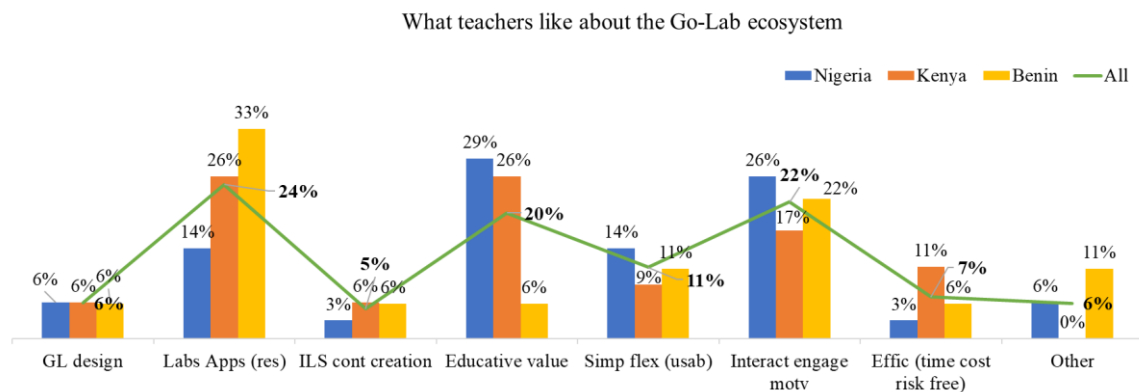


Figure 6: Users’ preferences about the Go-Lab ecosystem per country.

The percentages in the green line indicate the average of the three countries in each category. From left to right, the groups of columns respectively stand for *Golabz & Design*, *Labs & Apps* (resources), *ILS content & creation*, *Educative value*, *Simplicity & flexibility* (usability), *Interactivity, engagement & motivation* (learners), *Efficiency* (time & cost, risk free), and *Other*.

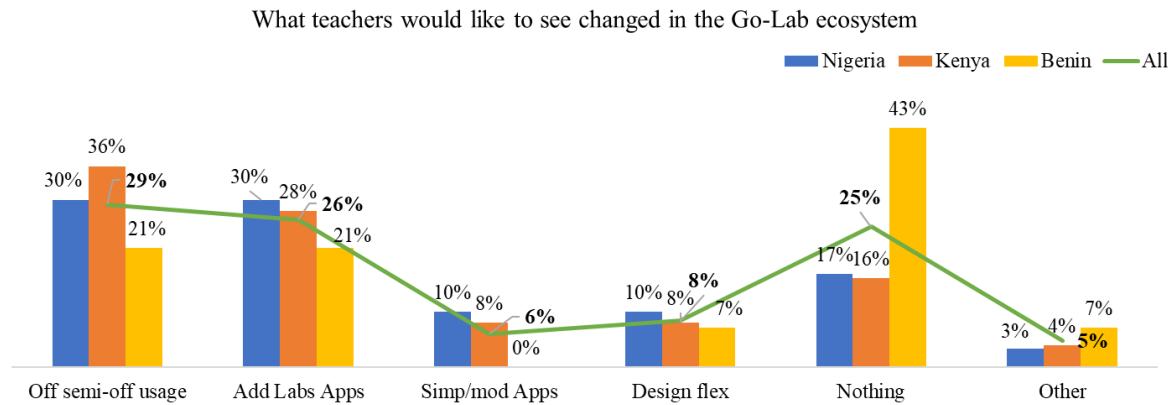


Figure 7: Changes proposed by the users per country.

The percentages in the green line correspond to the averages in each category. From left to right, the groups of columns respectively stand for *Offline/semi-offline usage*, *add more labs and apps* (local curriculum and subject domain), *simplified/modified apps*, *Design & design flexibility* (changing colours, fonts, background, etc.), *Nothing*, and *Other*.

Discussion

The analysis of the data allowed us to conclude that the translation of the platform was very important for French speaking countries. Most of the times, teachers changed the language using the drop-list function available in the platform instead of using the automatic tools from the browser. They were thus able to carry out their tasks successfully up to an acceptable extent (*i.e.*, the automatic translation did not prevent teachers to understand the contents or impaired their progress). The users seldomly accepted the cookies upon being notified to do so; they navigated the platforms using contextual links and menus beyond the main menu, main pages and landing page; they showed more interest in exploring the labs and ILSs than the apps; they explored the platform's teaching resources without reading about the project or the platform in the Support, News and About pages; and teachers needed frequent support to update their software (browsers and operating systems) and to understand the technical requirements for using the ecosystem, such as browser and operating system versions, JavaScript support, and internet connection speed.

The results of the adaptation and localization of the first prototype highlighted the need to bring more visibility to the Collections page and to expand the resources suitable for the national curricula in the pilot countries. The Collections page was adapted to the curricular needs of the Republic of Benin, Kenya, and Nigeria, but only two out of the 13 teachers testing the platform actually accessed that page (recall fig. 4). This apparently surprising behaviour is justified by the fact that the teachers involved in the testing and validation of the prototype were new users who have not yet been introduced to the ecosystem and, so, they naturally explored the first subpages of the platform (Labs, Apps, and Spaces).

In addition, the testing and validation sessions provided a unique opportunity to identify a crucial technical limitation: the lack of stable and fast enough internet in many pilot schools. That led to the decision of implementing performance improvement techniques and creating an offline version of the ecosystem, to allow for the implementation of the project where and when the internet was of poor quality or not accessible. Although it was not possible to make the full content available offline yet, key educational resources of the ecosystem (apps, labs

and ILSs), reflecting some of the most important needs in terms of STEM education at secondary schools in the three pilot countries, were selected and made available offline.

Conclusion

The aim of the testing and validation presented in this paper was to gather a deep insight about users' behaviour and interaction with the Go-Lab ecosystem. The results contributed to better understand how new users interact with the platforms (Golabz and Graasp), they helped to identify the most important features, and to pinpoint elements that require attention during training and support. The process was not smooth, since pedagogical aspects, such as familiarity with IBL and using online labs, and extraneous factors during the sessions, such as unstable internet connectivity and outdated software, played an important role in the users' interaction with the ecosystem. Even though these factors reflect the everyday reality teachers face in their classrooms, most of them were controlled and taken into account in subsequent sessions.

Multiple techniques were employed to collect information: video recordings, questionnaires, observation forms, activities, open discussions, and scenarios. These methods targeted for feedback and better understanding on how users interact with the platforms. The collected data helped to adapt and shape the ecosystem to meet the users' needs and requirements, both from the technical and pedagogical viewpoints. Examples of improvements driven by the testing and validation of the prototype include the expansion of the digital educational resources suitable for the national curricula in the pilot countries, the adaptation of the ecosystem to work with low internet connectivity, and the offline availability of some virtual labs, apps and ILSs. The latter was motivated by the technological challenges and constraints faced during the testing and validation sessions. Without the offline version of Go-Lab that has been released since, it would have been impossible to bring additional schools throughout the participating countries, especially those that are far from the main urban areas, where the information and communication infrastructures and services are typically scarce. The next testing and validation sessions will study the effectiveness of these improvements, including the creation and adaptation of new content (apps and labs), will test the newly developed offline features, and will assess the planned technical implementations for better performance with low internet connectivity.

Acknowledgment

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ASSESSMENT OF TEACHERS' CHALLENGES IN IMPLEMENTING THE SENIOR SECONDARY SCHOOL CHEMISTRY CURRICULUM FOR CLIMATE CHANGE CONTROL

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Abstract

Considering the importance of Chemistry curriculum and its implementation in overcoming challenges of humanity and the alarming increase of global negative effects of climate change, this study investigated Chemistry teachers' challenges in implementing the senior secondary school Chemistry curriculum for climate change control. The study was conducted using two hundred and sixty Chemistry teachers in Ebonyi state, South-East of Nigeria. The study adopted a survey research design. Two research questions and two hypotheses guided the study. One hundred and twenty Chemistry teachers randomly sampled from public secondary schools in three education zones of the state were used for the study. A validated, structured questionnaire developed by the researcher captioned Chemistry Teachers' Challenges in Implementing Chemistry Curriculum for Climate Change Control was used to collect data for the study. The questionnaire has reliability index of 0.76 as determined using Cronbach Alpha method of determining internal consistency of a test. The mean score and standard deviation were used to answer the research questions while t-test was used to test for the hypothesis at 0.05 level of significant. The study revealed that teachers have challenges in implementing Senior Secondary School Chemistry curriculum for climate change control. Again, gender has no significant influence on teachers' challenges in implementing Chemistry curriculum for climate change control. Recommendations made based on the findings of the study among others include the following: More periods should be made available for Chemistry class; ICT and other instructional resources that help to address climate change control should be provided for effective curriculum delivery.

Keywords: *Assessment, Chemistry curriculum, Climate Change Control and teachers' challenge*

Introduction

Climate change is an alarming global problem that poses health, economic and environmental threats in the twenty first century. The devastating effect is felt through erratic changes in the ecosystem which leads to extermination of some species of living organisms and frequent outbreak of epidemics, diseases and infirmities (Egbeama, 2015). According to Adigun (2017) there are unusual severe cases of storms, blizzards, tornadoes, typhoons, hurricanes, flooding and desert encroachments around the globe. All these have led to inestimable loss of live and properties in different parts of the globe.

In Nigeria unanticipated disaster caused by erratic climate change as manifested in annual flooding, erosion, land slide and desert encroachment led the Federal Government to set up the National Emergency Management Agency (NEMA) in 1999. The NEMA is among other related objectives, charged with mapping out strategies for disaster prevention. Since natural disaster is better prevented through climate change control, creation of awareness about climate change by NEMA is on going through social media and other agencies. The best preventive/control strategy for climate change could be acquired through education Ikegbusi (2019).

This is because education is a systematic process of bringing about permanent change in behaviour among the citizenry. Through education worthwhile values of the society are transmitted unto the young generation (Ezugo & Ofojebe, 2018). Although climate change can be caused by some natural factors such as change in solar radiation, volcanic eruption but quite consequential amount is caused by human activities which release emissions into the environment (Martin & Mahaffy, 2013). According to Adigun (2017), awareness and method of climate change control could be addressed through Chemistry education.

Chemistry is a science subject which studies interactions of matter from the particulate level and the energy consequences (Igboanugo, 2013). Chemistry brings about recreation through interaction of matter. The ability to recreate through Chemistry brings Chemistry at the centre of environmental changes. Chemical activities for recreation can make or mar the environment. Thus the societal expectation should be that through Chemistry education national/global issue such as the climate change control would be addressed.

This buttresses the importance of embracing Chemistry education by the society. Thus, Chemistry education is expected to inculcate the values necessary for improving the environment unto the younger generation (Adigun, 2017). In, Nigeria, the foundation of Chemistry education is laid at the Senior Secondary school (Igboanugo & Njoku, 2015). The quality of Chemistry transmitted at the Senior Secondary school education in a given generation is largely determined by the Chemistry curriculum (Igboanugo, 2018).

Chemistry curriculum systematically provides the totality of experiences, knowledge, skills and activities hoped to educate the learner for gainful employment or usefulness. This implies that issues addressed by Chemistry education are as stipulated in the Chemistry curriculum. An important complementary aspect of well planned and written curriculum is its effective implementation (Achimugu, 2012; Nwosu & Ibe, 2012). Effective implementation of the Chemistry curriculum is necessitated to among other numerous important issues provide solution to burning global issue such as climate change control. The teacher is the implementer of the curriculum (Arikpo & Odinko, 2019). Thus curriculum is implemented when the teacher successfully helps the young generations especially the learners realize their potentials in solving and minimizing personal and societal challenge such as the climate change control (Ezugo & Ofojebe, 2018). Perennial learners' poor achievement in internal and external examinations according to Igboanugo (2018) is an indication of ineffective implementation of Chemistry curriculum.

Researchers such as Egolum & Igboegwu (2013), Anugwo & Asogwa (2015) and Igboanugo (2018) have identified factors militating against Chemistry curriculum implementation as large class size, over-crowded curriculum, poor learners' interest, poor teachers' attitude, lack of instructional resources, inadequate equipped laboratory, poor teachers' remuneration, school location and inadequate capacity building for in-serving Chemistry teachers. Again, the influence of gender on Chemistry teachers' ability to deliver the Chemistry curriculum has been of concern to researchers. For instance, Ibe (2013) and Osuafor (2019) assert that teaching and learning process in sciences have continued to be plagued with gender biases of varying dimensions. This implies that gender which refers to the social discrimination among male and female might influence Chemistry teachers in implementation of the Chemistry curriculum. Again Igboanugo (2018) averred that school location can influence the outcomes of teaching and learning Chemistry. This also suggests that school location which is position or place where a school is relatively situated (urban or rural) might as well influence Chemistry teachers in implementing the Chemistry curriculum for climate change control.

Researchers such as Moses (2012) and Egolum & Igboegwu (2013) have attested to the need for periodic assessment of the level of the Chemistry curriculum implementation. Assessment is a systematic collection of information about the current situation of a programme or a system in order to make suggestion or take decision for improvement. The idea of having information about current situation implies that a programme or a system can always change and there is need to make judgments and comparisons over a period of time (Mohan, 2010). The importance of assessment in education programs cannot be over emphasized. Assessment helps to make value judgment about a programme to determine the strength and weakness of the programme for either retention or necessary modification (Osegbue, 2018). This provides an opportunity for a rethink in the aspects of education system for efficiency. Thus one of the main purposes of assessment in education is to enhance the realization of the educational aims and objectives. Olurinola, Hassan & Saka (2017) opine that assessment in educational system provides information that will assist stake holders in shaping educational decisions. Considering the importance of Chemistry curriculum and its implementation in overcoming personal and societal challenges such as the climate change control, the pertinent questions that needed answers might be: What extent have Chemistry teachers implemented Chemistry curriculum with respect to climate change control at different school locations? What are the challenges Chemistry teachers encounter in implementing the Chemistry curriculum with respect to climate change control? Has gender any influence on Chemistry teachers' challenge in implementing the Chemistry curriculum for climate change control?

Problem of the Study

Chemistry is a fundamental science subject expected to equip the citizenry with the knowledge and skills required to control environmental hazards. This is clearly stated in one of the objectives of the Chemistry curriculum in Nigeria as follows: 'to show Chemistry and its links with industry, everyday life activities and hazards'. Climate change is an environmental cankerworm that has attracted global attention that needs to be checkmated through Chemistry education due the danger it poses on the global ecosystem and economy. Since the Chemistry curriculum maintains that the curriculum has been structured to cater for the needs and aspirations of Nigerians in line with the contemporary global issues (FME, 2007) there might be the need to determine the challenges that are hindrances to implementing the Chemistry curriculum for climate change control. Thus the problem of this study was: what are the teachers' challenges in implementing the senior secondary school Chemistry curriculum for climate change control?

Purpose of the Study

The purpose of this study was to determine:

1. The teachers' challenges in implementing Chemistry curriculum for climate change control
2. The effect of gender on teachers' challenges in implementing Chemistry curriculum for climate change control
3. The effect of school location on teachers' challenges in implementing Chemistry curriculum for climate change control

Research Questions

The following research questions guided the study:

1. What are the teachers' challenges in implementing Chemistry curriculum for climate change control?
2. What is the effect of gender on teachers' challenges in implementing Chemistry curriculum for climate change control?

3. What is effect of school location on teachers' challenges in implementing Chemistry curriculum for climate change control?

Hypothesis

HO₁. There is no significant difference in the mean response scores of male and female teachers on teachers' challenges in implementing Chemistry curriculum for climate change control ($p < 0.05$).

HO₂. There is no significant difference in the mean response scores of teachers in urban and rural school locations on teachers' challenges in implementing Chemistry curriculum for climate change control ($p < 0.05$).

Methodology

The study adopted the survey research design. The area of the study was Ebonyi State South-East of Nigeria. Population of the study was all the two hundred and sixty (260) Chemistry teachers in the public Senior Secondary schools in the three Education zones of the State (SEB, 2019). The teachers were stratified into the education zones of Abakaliki, Afikpo and Onueke. Simple random sampling technique was used to select forty Chemistry teachers from each of the strata to get one hundred and twenty (120) Chemistry teachers (60 male teachers and 60 female teachers) used in the study.

Instrument for Data collection

The instrument used in gathering data for the study was a structured questionnaire developed by the researchers. The instrument was captioned Chemistry Teachers' Challenges in Implementing Chemistry Curriculum for Climate Change Control. The questionnaire had part A and part B. Part A sought for the personal data of the respondents while part B comprised of 16 items that relate to challenges encountered by Chemistry teachers. In Part B, the questionnaire was of four-point scale. There were four options of Strongly Agree (SD) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1. The respondents were expected to rate these items in terms of their agreement. The instrument initially comprised of 20 items was face validated by two experts in Chemistry education, one expert in Measurement and Evaluation and a secondary school Chemistry teacher. Their contributions which suggested reduction of the number of items to 16 also helped to ensure that each of the test items was understandable and relevant to the study. The questionnaire was trial tested on 30 teachers from secondary schools in Anambra State which is outside the area of study. The trial test helped to improve the quality of the test items and confirm the face validity of the items. Again, from the result of the trial test, reliability index of the instrument was determined to be 0.76 using Cronbach Alpha method of determining internal consistency of a test. The data collected using the questionnaire was analyzed using spss version 22 and the result used to answer the research questions and test the hypothesis for the study. The research questions were answered using mean score and standard deviation. In line with Arikpo & Odinko (2019), the criterion mean value was 2.50. This is considered as the benchmark since 2.50 is the average of the 4-point scale of 1, 2, 3 and 4. Items with mean value 2.50 and above indicated agreement while items with mean value below 2.50 indicated disagreement. The hypothesis was tested using the t-test at 0.05 value of probability.

Results

The results of the study are presented in Tables 1, 2, 3 and 4.

Table 1: Mean Rating and Standard Deviation of Responses on Teachers' Challenges in Implementing SSS Chemistry Curriculum for Climate Change Control

S/N	Item	Teachers (N=120)		Male (N= 60)		Female (N= 60)	
		X	SD	X	SD	X	SD
1	Insufficient number of Periods	2.50	0.30	1.67	1.14	3.33	0.75
2	Overcrowded curriculum	2.00	1.27	2.00	1.21	2.33	0.71
3	Students' lack of interest	2.33	1.16	1.67	1.30	3.00	0.64
4	Non availability of good textbooks	2.00	0.85	2.00	1.39	2.00	0.54
5	Teachers' un-resourcefulness	1.67	1.26	2.00	0.62	1.33	0.72
6	Lack of adequate instructional resources	2.17	1.33	1.67	0.81	2.67	0.61
7	Teachers incompetent and poor Knowledge of content matter	2.00	1.08	2.00	1.34	2.00	0.63
8	No productive link between Industries and schools	3.67	0.75	3.67	1.41	3.67	0.87
9	Lack of teachers' Professional Development	3.17	0.78	3.67	1.06	3.00	0.98
10	Poor Assessment Techniques	3.00	0.70	3.67	0.96	2.33	0.84
11	Teachers Overloaded with many Periods	2.00	0.71	2.00	1.11	2.33	0.82
12	Poorly Equipped Chemistry laboratory	2.17	0.93	2.00	1.01	2.33	0.70
13	Inappropriate Teaching Methods	1.67	1.19	1.67	0.69	2.33	0.83
14	Lack of ICT (Modern Instructional Materials)	3.65	0.09	3.97	1.27	3.33	0.73
15	Poor Teachers' Remuneration	3.65	0.11	3.97	1.10	3.33	0.61
16	Large Class Size	3.32	0.45	3.97	1.17	2.66	0.82

Research Question 1: What are the teachers' challenges in implementing Chemistry curriculum for climate change control?

Table 1 shows that the teachers' challenges in implementing Chemistry curriculum for climate change include insufficient number of periods for Chemistry class; no productive link between industries and school; lack of teachers' professional development; poor assessment technique; lack of ICT (modern instructional materials); poor teachers' remuneration and large class size.

Research Question 2: What is the effect of gender on teachers' challenges in implementing Chemistry curriculum for climate change control?

Table 1 shows the challenges of male teachers and female teachers in implementing Chemistry curriculum for climate change control. The male teachers' challenges in implementing Chemistry curriculum for climate change include no productive link between industries and school; lack of teachers' professional development; poor assessment technique; lack of ICT (modern instructional materials); poor teachers' remuneration and large class size. While the female teachers' challenges in implementing Chemistry curriculum for climate change include insufficient number of periods for Chemistry class; students' lack of interest; Lack of adequate instructional resources; no productive link between industries and school; lack of teachers' professional development; lack of ICT (modern instructional materials); poor teachers' remuneration and large class size. To determine whether gender has significant influence on teachers' challenges in implementing Chemistry curriculum for climate change control, hypothesis one was tested at $p < 0.05$ alpha level.

Table 2: Mean Rating and Standard Deviation of Responses on Teachers' Challenges in Implementing SSS Chemistry Curriculum for Climate Change Control in Urban and Rural Schools

S/N	Item	Urban (N=75)		Rural (N= 45)	
		X	SD	X	SD
1	Insufficient number of Periods	2.67	1.04	2.33	0.65
2	Overcrowded curriculum	2.60	1.31	2.40	0.81
3	Students' lack of interest	1.67	1.20	3.00	0.54
4	Non availability of good text books	2.00	1.19	2.00	0.74
5	Teachers' un-resourcefulness	2.30	0.32	1.03	0.12
6	Lack of adequate instructional resources	1.07	0.21	2.87	0.51
7	Teachers incompetent and poor Knowledge of content matter	2.02	1.44	1.98	0.63
8	No productive link between Industries and schools	3.66	1.11	3.68	0.97
9	Lack of teachers' Professional Development	3.65	1.06	3.05	0.68
10	Poor Assessment Techniques	3.17	0.76	2.53	0.84
11	Teachers Overloaded with many Periods	2.40	1.12	2.03	0.72
12	Poorly Equipped Chemistry laboratory	2.00	1.91	2.53	0.60
13	Inappropriate Teaching Methods	1.67	0.99	2.33	0.89
14	Lack of ICT (Modern Instructional Materials)	3.67	1.27	3.93	0.63
15	Poor Teachers' Remuneration	3.87	0.92	3.43	0.51
16	Large Class Size	3.87	1.27	2.56	0.82

Research Question 3: What is effect of school location on teachers' challenges in implementing Chemistry curriculum for climate change control?

Table 2 shows the challenges of teachers in urban and rural locations in implementing Chemistry curriculum for climate change control. The teachers' challenges in implementing Chemistry curriculum for climate change in urban location include insufficient number of periods; overcrowded curriculum; productive link between industries and school; lack of teachers' professional development; poor assessment technique; lack of ICT (modern instructional materials); poor teachers' remuneration and large class size. While the teachers' challenges in implementing Chemistry curriculum for climate change in rural location include students' lack of interest; Lack of adequate instructional resources; no productive link between industries and school; lack of teachers' professional development; poor assessment techniques; poorly equipped laboratory; lack of ICT (modern instructional materials); poor teachers' remuneration and large class size. To determine whether gender has significant influence on teachers' challenges in implementing Chemistry curriculum for climate change control, hypothesis one was tested at $p < 0.05$ alpha level.

Table 3: The t-test Analysis of the Responses of Male and female Teachers on Teachers' Challenges in implementing SSS Chemistry Curriculum for Climate Change Control

Groups	N	Mean	SD	Df	t-value	p-value
Male	60	2.61	0.81	118	0.12	0.91
Female	60	2.62	0.74			

$P > 0.05$

Hypotheses

HO₁. There is no significant difference in the mean response scores of male and female teachers on teachers' challenges in implementing Chemistry curriculum for climate change control ($p < 0.05$).

Table 3 shows that a t-test value of 0.12 associated with a probability value of 0.91 was obtained. Since the associated probability value of 0.91 is greater than 0.05, the null hypothesis was accepted. Thus the researchers concluded that there was no significant difference in the mean response scores of male and female teachers on teachers' challenges in implementing Chemistry curriculum for climate change control.

Table 4: The t-test Analysis of the Responses of Urban and Rural Teachers on Teachers' Challenges in implementing SSS Chemistry Curriculum for Climate Change Control

Groups	N	Mean	SD	Df	t-value	p-value
Urban	5	2.58	0.61	118	0.19	0.89
Rura	5	2.65	0.94			

$P > 0.05$

HO₂. There is no significant difference in the mean response scores of teachers in urban and rural school locations on teachers' challenges in implementing Chemistry curriculum for climate change control ($p < 0.05$).

Table 4 shows that a t-test value of 0.19 associated with a probability value of 0.89 was obtained. Since the associated probability value of 0.89 is greater than 0.05, the null hypothesis was accepted. Thus the researchers concluded that there was no significant difference in the mean response scores of teachers in urban and rural school locations on teachers' challenges in implementing Chemistry curriculum for climate change control.

Discussion of Findings

Results of this study show that teachers have challenges in implementing Senior Secondary School Chemistry curriculum for climate change control. The results are in line with Nwosu & Ibe (2012); Egolum & Igboegwu (2013) and Arikpo & Odinko (2019) who averred that teachers face a variety of challenges in attempt to implement the curriculum. Again, the observed difference in the mean response scores of male and female teachers on teachers' challenges in implementing Chemistry curriculum for climate change control was not statistically significant as confirmed in Table 3. Results in Table 4 also confirmed that there is no significant difference in the mean response scores of teachers in rural and urban school locations on teachers' challenges in implementing Chemistry curriculum for climate change control. This is in consent with Igboanugo (2018) who maintained that neither gender nor location influences Chemistry teachers' performance in Chemistry curriculum implementation. Teachers are confronted by the same challenges in implementing Senior Secondary School Chemistry curriculum for climate change control irrespective of gender or school location.

The teachers' challenges in implementing Senior Secondary School Chemistry curriculum for climate change control include insufficient number of periods for Chemistry class; students' lack of interest; Lack of adequate instructional resources; no productive link between industries and school; lack of teachers' professional development; poor assessment techniques; lack of ICT (modern instructional materials); poor teachers' remuneration and large class size. Insufficient number of periods would not allow the teachers to fully address the over loaded Chemistry scheme of work. Teachers give skeletal touch to such social issue as climate change control because of want of time. The required practical learning experience in most cases is not provided. Such strategy as field trip to industries and other important sites for learners to have firsthand experience about climate change and the control require time and materials which in most cases are not available. This is in agreement with Igboanugo (2018) who maintains that Chemistry teachers' zeal to cover the scheme of work under a limited time for external examinations is an impediment to using certain adequate strategies that would relate Chemistry to real life problems of the learner.

The results also show that poor assessment technique is teachers' challenge in implementing the Chemistry curriculum for climate change control. The assessment techniques in use by the teachers probably are inadequate to provide proper result and feedback to the learner about climate change control. This is in line with the findings of Nwosu&Ibe (2012) which revealed that science teachers do not make use of assessment techniques such as anecdotal records, check list, inventory, projects and practical.

Lack of teachers' professional development and poor teachers' remuneration are challenges to the teachers as revealed by the findings. The two factors could jeopardize teachers' creativity and zeal to put in their best in implementing the Chemistry curriculum. This collaborates with Achimugu (2012) who highlighted poor remuneration and poor teachers' professional development as factors militating against successful implementation of science curriculum in Nigeria.

Again, the results showed lack of ICT instructional materials as a challenge to the teachers in implementing the Chemistry curriculum for climate change control. This is in consonance with Arikpo&Odinko (2019) who found out that most schools in Nigeria lack ICT materials for instruction. Availability and adequate application of ICT in Chemistry instruction can boost the interest of students in learning as well as make the concepts topics/concepts about climate change control tangible and less abstract. Thus availability of ICT instructional materials might be an antidote to the observed challenge of students' lack of interest in Chemistry instruction for climate change control. The implication of the challenge of large class size is that teachers have problem of class control. Also, to give required individual attention to learners during instruction becomes difficult.

Recommendations

Based on the findings of the study the following recommendations are made:

1. More periods should be made available for Chemistry class. This could be done through extramural class
2. ICT and other instructional resources that help to address climate change control should be provided for effective curriculum delivery and boosting learners' interest

3. School proprietors should encourage Chemistry teachers to link climate change issues to industries through field trips and/or invitation of industrialists as resource persons to Chemistry class
4. School proprietors should organize regular workshops and seminars for in-service Chemistry teachers on effective climate change control instruction
5. Fringe benefits and welfare packages for Chemistry teachers should be made available by school proprietors
6. Adequate number of Chemistry teachers should be employed to reduce the class size.

Conclusion

Climate change control is an issue that draws global attention because of the threats posed on social, economic, political and environmental survival of the globe by recent erratic climate change in different parts of the world. From the foregoing, Chemistry education is a viable instrument for enshrining climate change control measures among the citizenry. Thus, implementation of the senior secondary school Chemistry curriculum has a far-reaching implication for ensuring climate change control. The result of this study is an eye opener to stake holders in education and Chemistry education in particular such as the school proprietor, Chemistry teachers, the institutions for Chemistry teacher education and the society in general in tackling challenges involved in Chemistry curriculum implementation for societal benefits. The results have to some extent revealed some of impediments militating against teachers' efforts in implementing the senior secondary school Chemistry curriculum for climate change control in under developed country like Nigeria. In an attempt to providing measures for climate change control, these impediments against implementation of Chemistry curriculum for climate change control need to be addressed. If these impediments are properly addressed, the senior secondary school students will understand the rudiments of climate change control through Chemistry education. This will ensure adequate awareness for climate change control among significant percentage of the populace for global safety. Some of the recommendations made in this study might be useful.

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COMPARATIVE ANALYSIS NAVIGATING THE HURDLES OF CRISIS MANAGEMENT IN AFRICA: IMPLICATION FOR UNIVERSITY PRODUCTIVITY AND PERFORMANCE

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Abstract

Universities in Africa are wallowing in the abyss of uncertainty in goal achievement. This is not because the universities are not established with a solidified management system, nor because they do not have adequate and appropriate human capital, but the trajectory of people's management has redressed the fabric of university education towards cacophony. Virtually all universities are battling with student-oriented crises of various dimensions and magnitude which have practically hindered the actualisation of the set predetermined goals and objectives. In response to this, we presented the challenges associated with the management of students'-oriented crisis/unrest in the university system; we explored comparative solutions in response to the challenges and lastly presented conditions for the solutions to strive. This study found out that effective communication and inclusive engagement propounded in Ghana, the implementation of threat assessment plan propounded in the United States. and the Sri Lankan approach of university autonomy and adequate funding are possible solutions to incessant students' unrest in the university system. The study, however, concludes that the universities in Africa will enjoy uninterrupted productivity and students' academic success if these solutions are adequately implemented.

Keywords: *Comparative literature, Crisis management, University productivity, Students' performance.*

Introduction

Teferra and Altbach (2004), Assie-Lumumba (2006), and Nsereko (2018) confirmed that African universities are under siege of various crises, most especially the crisis emanating from students' disagreement with university authorities. This was historicised by Atteh (1996) as a trajectory that has been in the leak since the 1960s confirming that although universities were established to be agents of modernisation, economic growth, and social mobilisation, however, inadequate financial and physical resources in the system have caused the universities in Africa to disengage their intentions as agents of social engineering with various magnitudes of setbacks. These setbacks have been linked to inadequate educational resources, equal access to education, adequate and qualified personnel, leadership and management styles, funding and political interferences (Fakunle, 2016; Omodan, 2016; Omodan, Ekundayo & Bamikole, 2018). Relevant experiences, data, and social analysis show that most African countries such as Nigeria, South Africa, Ghana, Kenya, among others, made comparable achievement between the 1960s and 1970s in higher education; this compliment, according to Atteh (1996) is consistently disappearing.

As a result of these prevailing issues, student-oriented crises and unrest in the university system could be adjudged to the incomparable decline in resource allocation to the universities by the governments of the understudied countries. Two significant countries in Africa; Nigeria and South Africa, are case studies justifying students' unrest due to the inadequacy of resources in universities. The Fees-must-fall struggle in South Africa was

described by Jansen and Walters (2019) as the most intense and volatile students' protest and the Ali-must-go struggle in Nigeria according to Wahab (2018) is the mother of all protests in Nigeria. These two cases of students' unrest confirm the notion that many African countries are unstable in their goal achievement; therefore, the need for the study. The Fees-must-fall protest in South Africa was linked to factors such as separating cultures of historically white universities, associated with the discriminatory cost of higher education and the unequal distribution and universal access to university education (Jansen & Walters, 2019). In the analysis of Londa (2017), the Fees-must-fall protest started in the University of Cape Town in 2015 and spread across the country up until 2016. During this period, the students' demands were centred around the reduction in the outrageous and discriminatory cost of university education, and the decolonisation of education and university transformation to bridge the gap between inequalities and social brigandage.

In the Nigerian context, Ali-must-go students' protest started at the University of Lagos, in 1978, when students started to boycott lectures (Adeseri, Umoru & Olatunji, 2014). This struggle quickly spread to other universities because the students' demands were seen as a collective struggle that applied to all tertiary institutions in Nigeria. The students, through their national body, National Union of Nigerian Students (NANS), led by President Segun Okeowo, was contrary to the fees increase by the then government represented by the Minister of Education, Hon. Ahmadu Ali (Madunagu, 2017). The students mounted pressure on the government to reduce the school fees increment and to further proffer solutions to the problem of university funding which, of course, has not yet been achieved till date (Ogunlade, Ekundayo & Omodan, 2015).

From the demands of the above-mentioned examples of students' unrest, it is evident that the long-term aims of the students in both countries were to ensure that education is democratised with substantial and adequate funding. Sadly, the current trend of university education in both countries show that the struggles, to some extent, have not yielded an improved quality of education for the students. These social unrests in the university system are not only limited to South Africa and Nigeria; it has become endemic in African universities and beyond. Research has shown that they occur in countries like Kenya, the United States of America, Sri Lanka, Ghana, Papua New Guinea, among others (Weeramunda, 2008; Virginia Commonwealth University, 2012; Dube & Hallel, 2018). These social crises in the education system have hindered university productivity, academic performance, peace, not forgetting that the relative tranquillity of the university environment is under threat. It is against this lacuna that this present study explores comparative literature to provide solutions to the menace of social unrest between students and university authorities in Africa.

Research Question

To provide solutions to the above problem of incessant crisis in the university system in Africa, the following question is formulated to pilot the study: How can comparative literature be explored to respond to the issue of student-oriented crises emanating from dichotomies between students and university authorities and/or government?

Aim and Objectives of the Study

The aim of the study is, therefore, to respond to the issue of social unrest and or crisis emanating from the dichotomy between student-governments/university authorities' through

an exploration of relevant comparative literature as a panacea to ameliorating university unrest in Africa. By doing this, the following objectives will guide the study:

1. Examine the challenges associated with the management of student-oriented crisis/unrest in the university system.
2. Explore comparative solutions to the challenges of managing student-oriented crisis/unrest in the university system.
3. Present the possible conditions for these solutions to thrive.

Challenges associated with the management of a student-oriented crisis

To respond to the first objective, a rigorous focus is centred on the exploration of various challenges associated with the management of crisis between students and university authorities. This is done under the following sub-headings: Communication and dialogue, Cultism, and Inadequate funding.

Communication and Dialogue

Various accusations have been made by students' union leaders from different students' organisations that tertiary institutions including universities have been adamant to communication strategies in their management system, ranging from their lack of dialogical principles to ensure that students' voices are heard (Mbui, 2016). This development constitutes part of the challenges that posted the need for universities to intensify the use of various communication strategies such as social media and other communications channels in crisis communication and management. According to Bundy, Pfarrer and Coombs (2015), effective crisis management does not only rely on the action taken at the heat of crisis but also involves a constant preventive mechanism and control. This is supported by Coombs (2014) that crisis management is aimed to prevent or lessen the effect of crises on organisations in which the university is not an exemption. One of the fundamental features embedded in crisis management is crisis communication which involves the dialogue the managers of the organisation engage with its stakeholders before the crisis, during the crisis, and after the crisis (Fearn-Banks 2007). Coombs (2006) also reiterated that the main aspect of crisis communication is to provide information to all relevant stakeholders, which, according to him, will further protect the image of the organisation. That is why the university system needs to be prepared at all the time since conflict appears to be inevitable. If any institution fails to prepare, it is preparing for more damage (Bernstein, 2013).

In Africa, almost all the student-oriented crises have been linked to the nonchalant attitude of the universities' managers towards the handling of organisational communications before, during and after the crisis which usually makes the students feel unimportant, unrecognised or kept in the dark from the information. The outcome of this at the most time is the point of students' agitation. This has also reflected in the findings of Adeyemi (2009) that effective communication has not been strategically put in place to control or manage students' crises in public universities. This challenge is capable of attracting adverse relationships between the students' unions and the authorities of the universities. Maybe that is why Nwankwo (2014) concluded that information and dialogue are needed in an organisation to maintain peace and tranquillity for the smooth running of the system. Marcia and Rock (1997) findings confirm the above statement that the lack of effective communication and dialogue remains a huge challenge to crises management in the university system. This reflects the fact that the university authorities do not disseminate information well-enough to the students and there is a huge tendency for misinterpretation even during dialogue. In response to this, Bentley

(2012) found out that the public perception about the dialoguing skills of administrators seems to have been driven into the circumstantial constraints of power politics.

This challenge seems to have adversely affected the goals and objectives of the universities by their supposed lack of knowledge or lack of readiness to recognise the importance of students as part of the fundamental human recourse in the system. This view was corroborated by Olu and Abosedi (2003) who held that there is no particular procedure in handling student-oriented conflicts and thereby make university administrators engage in trial and error approaches. This also reiterates our observations that the occurring and reoccurring of crises on campuses are as a result of the perspective of university managements who think it is unnecessary to negotiate with students through dialogue to find a lasting solution to issues. The May 8, 2009 crises between the students and the university cadet corps in University of Ado Ekiti now Ekiti State University is a vivid example of management negligence in the use of dialogue as a means of preventing student crises (*Daily Trust*, 2009). The Ekiti State House of Assembly (EKHA) based on the provisions of the *1999 Constitution of the Federal Republic of Nigeria*, section 128, investigated the event and further affirmed that there is lack of communication and dialogical strategies of the university management (*Daily Trust*, 2009).

Cultism

Cultism could be best explained as the activities of a group of individuals that are associated with secret cults (Inyang, 2017). A secret cult is also referred to as organisations whose mode of operation and membership are considered antisocial and propagate peculiar hidden beliefs divulged only to members (Mediyanose, 2016). This is in line with the Latin origin of the word 'occukre' which means something hidden, occulted, enigmatical, mystical, concealed and mysterious (Orukpe, 1998:1). Above all, cultism may be regarded as systemic beliefs bounding together people of the same interest to promote and defend the common pursuit generally believed to be in ritual engagement and dangerous practices (Ajakaiye, 2002). Ajayi, Ekundayo and Osalusi's (2010) definition also affirm the secrecy and functionality of cultism as well as their structure which includes membership, recruitment of members and other activities that are kept within their purview. Unfortunately, the negative effect of their activities is not limited to their members alone, but members, non-members and the entire university community.

Cultism, according to Chinwe and Mag (2014), is one of the major problems hinging the development of the educational sector in West Africa. Studies have shown that several peaceful protests made by student-leaders have been reportedly hijacked by faceless groups (cultists) thereby causing mayhem and escalating issues and these have resulted into the deaths of both members and non-members on campus, destruction of lives and properties, and the eventual closure of institutions. This has made it difficult for universities to smoothly operate and actualise their aims and objectives (Eneh, 2008; Alanamu, Olanrewaju & Muhammed, 2018). As of 2003, over 5000 students and lecturers have reportedly died from cult-related violence and clashes in various Nigerian universities (Okwu, 2006). Among the deadly incidents of cult crises in Nigerian institutions, Jekayinfa (2008) account stands out. According to him, the Principal Assistant Registrar was murdered in cold blood by cultists over the issue bordering on school administration in Delta State University, Mr Ileoje of the Institute of Technology (IMT), Enugu was shot in his office by a female cult member early in 1997. Early in 1997, a final year Banking and Finance student at the Ondo State University, Ado Ekiti (OSUA) was killed for deflection. He was murdered in his hostel after renouncing cultism. On July 10, 1999, seven undergraduates of Obafemi Awolowo University (OAU)

Ife, were murdered in cold blood in their sleep by secret cult members from within and outside the campus. At the University of Ibadan, the Chief Security Officer was brutally beaten by cult members in the presence of his wife and children."

Recently, two students were reportedly killed by suspected cultist in March 2018 during a protest at the University of Calabar (UNICAL). Also, over fifteen underaged age boys and girls of secondary schools were paraded by the Lagos State Commissioner of Police; they were believed to be members of a cult group terrorising their fellow students and school leaders (Oguntade, 2018). The unabated atrocities of secret cults in educational institutions and even in the wider Nigerian society continue to take tolls on the lives of young and old Nigerians (Eneh, 2008). Despite all efforts to bring the problem into the mud, the reverse is the case in higher institutions because such incidents keep increasing daily. This led to Christopher and Stanley (2015); Rotimi (2005) conclusion that solutions given so far to the menace "seem like putting out an inferno without any proper attempt made to identify the sources of the inferno's fuel". This may be connected to allegations that cultists have a clandestine relationship with the government and some powerful members of university authorities (Christopher & Stanley, 2015). In other words, cultists were mostly used by politicians and people in authority for political and personal gains. Some vice-chancellors of universities were alleged of sponsoring cultists to silence the voice of their perceived oppositions which at most times are student union leaders (Ogidefa, 2008). Cultism, therefore, in Nigerian universities has become a major social problem with obvious retrogression on the universities and the entire stakeholders (Alanamu, Olanrewaju & Muhammed, 2018; Oguntade, 2018; Calabar, 2018).

Inadequate Funding

The funding of universities in Africa appears to be one of the challenges and causes of crisis between students and the management authorities. Although the challenge, in our experience is not only limited to funding but inadequate financing and underfunding, which has contributed too many crises erupted in tertiary institutions. In so many instances, the concerned stakeholders have drowned the attention of various levels of government to the trajectory of inadequate funding in Nigerian higher institutions, including universities. This suffices to the fact that the government of Nigeria finds it uneasy to meet the increasingly high cost of funding its higher institutions (Famade, Omiyale & Adebola, 2015). This was corroborated by Ibukun (2004) who observed that Nigeria spent as low as 5.1 per cent of her annual budget into education between the year 1987 and 1997. In the same vein, Arikewuyo (2004), in a study conducted in 2004, also confirmed that the funding of education drastically dropped to 1.81 per cent from 11.12 per cent from 1999 to 2004. To further buttress our argument, Chinyere and Mukoro (2016) confirmed that since the advent of democracy in 1999, Nigeria's budgetary allocation to education has not exceeded 13 per cent.

Afe (2014) compared the budgetary allocation of twelve African countries such as; Ghana with 31.0 per cent, Cote d'Ivoire with 30.0 per cent, Uganda with 27.0 per cent, Morocco with 27.0 per cent, South Africa with 25.8 per cent, Swaziland with 24.6 per cent, Kenya with 23.0 per cent, Botswana with 19.0 per cent, Tunisia, 17.0 per cent, Lesotho with 17.0 per cent, Burkinafaso with 16.8 per cent and Nigeria 8.4 per cent. From this analysis, one can see that only Ghana and Cote d'Ivoire find their place close to the UNESCO benchmark.

It is evident that the government seems not to take cognizance of the importance embedded in the adequate funding of education which is significant to poor quality of graduates

(Ogunlade, Ekundayo, & Omodan, 2016). The success of any organisation will not be unconnected with the proper implementation of financial plans, and the availability and utilisation of available financial resources (Ahmad, Farley, & Naidoo, 2018). A critical example to buttress the above is evidenced in the various protest held by students' unions on campuses which led to the shutdown of academic activities and closures of the universities as a result of students' agitation for a reduction in tuition fees and the abolition of other irrelevant fees. Part of these crises, according to *Premium Times* (2017) happened in Obafemi Awolowo University, Ekiti State University, Ladoke Akintola University and University of Lagos, University of the Free State, and University of Kwazulu-Natal South Africa. It has also been observed that most of the propellers of student unrest are likely to lack of essential educational facilities like equipped libraries, lecture theatres, laboratories apparatus, furniture, and conducive environmental-climate, among others (Omodan, 2016; Ogunlade, Ekundayo & Omodan, 2016). The insufficiency in the above listed educational facilities and students' agitations for the provision of social amenities is also linked to the poor funding of the system (Fakunle, 2017).

Comparative solutions to the challenges of managing student-oriented crisis

This section responds to the second objective of the study by exploring various suggestible solutions propounded from different countries to respond to the challenges facing the management of universities as a result of student crises in the university system. This is done under the following headings; Effective communication and inclusive engagement: Ghana approach, Implementation of threat assessment plan: US approach, and University autonomy and adequate funding: Sri Lankan approach.

Effective Communication and Inclusive Engagement: Ghana Approach

Student leaderships alongside management of tertiary and high schools in Ghana during the Ashanti Regional Students' Representative Council 20th Annual Residential Congress that was held at Tepa Senior High School on 30th of July to 4th of August 2017 has propounded a lasting unanimous solution to the menace of student unrest in Ghana. This union's conference constituted various committees to look into the various bones of contention and reasons for the unabated students' crises in Ghana. According to Ferdinand (2017), who reported the event, he said that the student leaders, alongside other stakeholders, identified the causes of students' crisis as a result of lack of effective communication and lack of engagement between the students and schools authorities which universities were among, weak student leadership, weak security systems as a result of management deficiencies were also identified. To support these deficiencies, Gyan and Tandoh-Offin (2014) had earlier retreated that schools' administrations in Ghana have not lived up to expectations in terms of conflict resolution which is believed to be centred on autocratic leadership styles and conflicts of interest. Meanwhile, Ghana is one of the Western African countries who share similar educational background and experience with Nigeria alongside similar challenges as reflected in Atteh (1996), who argues that the root causes of the current educational crisis in Africa cannot be separated from their historical and social backgrounds.

Based on the lingering identified problems, the stakeholders unanimously resolved that proper engagement between student leaders and institutional authorities will enhance the management and prevention of conflict between the students and authorities of institutions. This, according to them, could be achieved by recognising local SRCs, rights of students, a friendly all-welcoming leadership style and effective communication through print and social

medial (Ferdinand, 2017). Gyan and Tandoh-Offin's (2014) findings also confirm the need for a student-management synergy and recommend in line with the above solution that school administrators should be availed various effective communicative strategies by allowing students to participate and be involved in decisions and dialogue that concern them and their welfare. In my view, this is one of the modern ways of preventing and managing both internal and external conflict before it degenerates into an inevitable crisis. This is adequately in line with the conclusion of Omodan, Dube & Tsoets (2018) that “consensuses building and facilitative leadership as a variable of collaborative governance are not only appropriate but also essential in the management of all kinds of crisis in the university system and, should, therefore, be enhanced.” This technique, therefore, could be referred to as participative management styles with a dialogical mechanism to managing and preventing crisis. This could be useful in any countries or institutions for peaceful coexistence.

Concerning this, the human relation approach to management still stands the test of time with this solution as it also reiterated the inclusivity in the management of an organisation. This is indicated in the statement of Stoner and Wandel (1988) and Omodan, *et al.* (2018) that stakeholders of organisations desire to be involved in the process of development and that when there is a good relationship between the management and other stakeholders, this will propel good human and acceptable human relations for better productivity. This dialogical relatedness also argued by Oraemes (1997) and Omodan, *et al.* (2018) that when students are treated with humanity, it increases democratic efforts and practice is most suitable for smooth operation, which in my view, could also stand as a point of motivation for students for better productivity. Given the above, effective communication and inclusive engagement shows to have various peaceful impacts in the operations of university systems because the frequent the communicative interaction between individual or groups of individuals, the greater the possibility to co-operate and get attached to work together (Odionye, 2014).

Implementation of Threat Assessment Plan: US Approach

A threat assessment plan according to Cornell (2003) is conducted when an individual or groups of individuals threaten to commit an act or engage in behaviour that could dilute the peace in an organisation; this kind of deliberate behaviour leading to violence is referred to as targeted violence (McGovern, 2010). This technique, according to Fein and Vossekuil (1999), is an approach to violence prevention originally developed by the US Secret Service. This development was based on the result of the examination of an individual who threatened to attack public officials. This was adopted as a systematic strategy for analysing violence situations (Fein & Vossekuil, 1998). In a bid to find a lasting solution to the rampant school shootings in the United States of America, Reddy and his colleagues agitated for the establishment of threat assessment at all levels of education. This led to the recommendation made by Fein, Vossekuil, Pollack, Borum, Modzeleski and Reddy in (2002) to the United States Secret Service and the Department of Education that schools should identify and train threat assessment teams to respond to student-oriented crises on campuses (Fein, Vossekuil, Pollack, Borum, Modzeleski, & Reddy, 2002).

To further respond to the challenges of crisis management between students and university authorities, the implementation of threat assessment plan was reiterated by the United States Secret Service National Threat Assessment Center (NTAC) in July 2018. The operational guidelines were released for possible schools' violence resorting from student disagreement with school administrators and or its members of staff. According to EduRisk (2018), the intervention of NTAC in the management of violence on campuses led to the

establishment of minimum guidelines that could enhance the established violence prevention plan and threat assessments on various educational campuses. The NTAC recommendations as captured by EduRisk in www.edurisksolutions.org can help schools ensure that their student threat assessment process is well-equipped to identify and address student behaviour that might pose as a threat of violence on campus. Part of the recommended checklist that could be enhanced by schools are the creation of a safe school climate, formulation of a threat assessment team, making use of the team by transmitting information to the team, and the assessment of the reported information with intervention and management as listed.

This intervention was recommended because of the prevalence of school violence ranging from school shootings, gangsterism, physical assault; with or without weapons, use of objects to attack or intimidate another person, and all forms of antisocial behaviours of students on campus (Virginia Commonwealth University, 2012) and for school administrators to be able to establish a new threat assessment process in their institutions, evaluate possible likely cases of violence and prevent them. The statement by Cornell (2003) further confirms the usefulness of threat assessment as a flexible approach that guides the school on possible ways to respond based on the seriousness of the threat. Since a threat assessment plan is a process of ensuring the evaluation of threat that could metamorphose into crises or violence, it is also expedient of university authorities to formulate threat assessment teams to critically analyse the causes of irrational actions and behaviour of students.

University Autonomy and Adequate Funding: Sri Lankan Approach

The research conducted by the National Education Commission (NEC) in Sri Lanka on the apparent socio-political effect and impact of student violence and indiscipline in universities and all tertiary education institutions led to the formulation of a unanimous solution towards identifying policy options that could enhance peaceful existence of stakeholders in higher education. The study, according to Weeramunda (2008), took place in August 2007, in three selected universities in Colombo District, Western Province of Sri Lanka. This, according to Weeramunda (2008) became necessary since violence and indiscipline in the universities hide under multifaceted causes, among which are the acts of violence among university students who made it clear that the government had fallen short of executing its self-appointed role as the final arbitrator and decision-maker in university matters which requires multi-dimensional solutions for rethinking conflict resolution mechanism. This was because students' crisis and all forms of institutional violence was on the increase as a result of the persistent government control of universities finance and decision-making positions which made it practically impossible for students to be satisfied by their institutional authorities (Weeramunda, 2008).

The outcome of the panel of research enquiry to the problem of students' violence in Sri Lanka recommended as follow: government's roles in the affairs of universities should be restricted to funding alone, by providing financial support to universities devoid of political interference. That the government should also grant total autonomy to the universities to nip in the bud the potential of students' violence in the universities. This scenario also has comparative correlations with the situations in Nigeria and South Africa as revealed by Ogunlade, *et al.*, (2015:5) that “inadequate funding and educational facilities had at many times propelled unavoidable disagreement between the unions and management of tertiary institutions.” In tertiary institutions, lecture halls, laboratories, students' hostels, library space, books, office space are all inadequate (Ochuba, 2001). Studies carried out by World Bank

(1994) and Adeyemi (2009) reveal that the necessary equipment for teaching, research and learning are either lacking or inadequate. This, therefore, could be argued that when there are adequate funding and availability, adequate educational facilities will probably dispel possible dichotomy among the stakeholders of universities.

Presentation of the possible conditions for the solutions to strive

In further response to the third objective of this paper, this section explores the conditions necessary for the successful management of crisis between students and university authorities. This is done under the following sub-themes; Students' involvement in decision-making and Provision of student personnel services.

Students' Involvement in Decision-making

The involvement of students in decision-making as one of the conditions necessary for effective management of crises in the university system is a complementary perspective to decision-making which is one of the important aspects of an organisation, including the university system, which determines the daily operations of the system (Oni & Adetoro, 2015). This is also referred to as the participation of students' bodies such as unions and their parliament including departmental representatives in the decision-making bodies of the school (Jeruto & Kiprop, 2011). In the argument of Jeruto and Kiprop, the term is used to refer to all aspects of university life, operations and decision-making where students and other stakeholders are involved to make a formal contribution through purposely created platforms. Ajayi (1991) perspective also complements the above opinions that the involvement of students in decision-making opens a mutual dialogue between the authorities and students not only for consultation and survey of students opinion. Luescher-Mamashela (2013) concludes that the participation of students in university committees remains the best way to manage or prevent disagreement and crisis because it gives room for students-authority engagements on both internal and external issues.

The above conceptual understanding opens the need for universities and other schools to practise all-inclusive governments as it was discovered that many universities do not practise this. In light of the above, Adeleke (2000) observes that student involvement in decision-making is not well-embraced and accepted in African universities, which according to him, may be due to the cumbersome and bureaucratic nature of the educational system in Nigeria. This is often seen as problematic to university administrators and other decision-makers in general because students are viewed as youngsters, unripe, and therefore lacking the requisite knowledge needed to run the affairs of a school (Oni & Adetoro, 2015). Thus, the act of neglecting students from participating in a decision directly or indirectly affects them has been the bone of contention because of its negative output (Fajana, 2002). Therefore, to successfully manage any matter related to students most especially on dichotomous issues that could result in crisis, the use of inclusive decision-making is encouraged. This view aligns with Odu (2014) who insists that consistent dialogue between students and university authorities through participatory decision-making will go a long way to breach the communication gap and thereby encourage a harmonious relationship between students and their institutional authorities which will, in the long run, curb frequent and avoidable students' unrest in universities.

Provision of Student Personnel Services

Students who constitute the largest proportion of human capital in the university system should be one of the utmost concerns of school managements in ensuring equitable access, motivation, welfare and opportunities for all students irrespective of their level. Hence, the

objectives of student personnel services are likely to assist students to attain self-realisation, become effective in their social environment and, in turn, complement the academic programmes of the university. Akinnubi and Kayode (2012) are of the view that students' personnel services are welfare services provided by the universities to ensure students' academic conformability and prevent and manage the rate of antisocial behaviours of students to promote positive thinking towards the schools and their future career. That in all universities, the managers in charge of student personnel services are saddled with the responsibilities to provide adequate assistance to students on finance, health, food and housing, provide a variety of co-curricular activities, approve and monitor activities to recognised student organisations, implement students' code of conduct and recommend appropriate disciplinary action to school authorities if need be (Onuma & Ada, 2016). Based on the above, student personnel services, therefore, refers to the services rendered by the universities to enhance the smooth operation of students' activities, ranging from academic activities through the provision of social and education amenities, social activities through the provision of all social amenities to ensure quality standard of living.

Ejionueme (2010) explains the relevance of student personnel services to conflict management by saying that although it received very little attention from academic literature and school administrators, it remains an administrative function that is critical to the effective management of student-related issues. In line with the above, Akpan (2016) holds that students' personnel services such as quality health services, physical facilities, material, equipment and library facilities and effective management of them are interrelated and contribute immensely to creating a congenial learning environment for students. Since student personnel services in higher institutions are significant to the achievement of academic, physical, psychological and social well-being of the students, university authority should ensure the adequate provision of student personnel services in a bid to prevent possible antisocial behaviours of students. This becomes a condition for uninterrupted management mechanism that could be used to manage unintended protests and crises by students. This notion is expedient because major problems facing the schools according to Onuma & Ada (2016) are lack of housing, lack of infrastructures, poor social amenities, lack of electricity and shortage of water supply which has led to various students' unrest in universities in Africa.

Conclusion

In conclusion, peace and tranquillity in any organisation, including the university system, play a pivotal role in determining the overall productivity and performance of the system. One could deduce from the study above that the aims and objectives set for i predominant operations can only be ensured where the operators operate without obstructions from any quarters, be it from students' or otherwise. In this case, the existence of peace stands as a motivation for all stakeholders to strive well and balance their respective duties in ensuring a productive achievement. This is expedient because motivation is said to have significant contributions to the general productivity and performance of staff and students (Yaya, Uzohue & Akintayo, 2016). In this context, productivity is conceptualised to mean the ability to produce unquantifiable graduates for society. Meanwhile, the success of any organisation, be it educational or corporate, is to actualise the levels of productivity in due course and within the ambience of its set goals and purpose. This success can only be achieved in an organisation free of acrimony and disharmony.

Furthermore, success is not only limited to the assurance of peaceful coexistence but also the internal efficiency and effectiveness towards the well-being of all stakeholders in the organisation. Productivity in the university also reflects the efficiency and effectiveness with which both human and material capital including time is utilised to produce a valuable output (Haasen, 1973). Hence, the greatest gains result in productivity when all actions occur simultaneously within the laid down process (Donnelly, 1971). This, in turn, can only be achieved if there is no disagreement and misunderstanding in the system. In achieving this anticipated success, all practical actions as exemplified above should be taken to improve productivity and students' performance because these provide opportunities for raising the general standard of living, and opportunities for the development of both universities and human capital.

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ACADEMIC COMPLAINTS SUBMISSIONS THROUGH A COMPUTERISED SYSTEM

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Abstract

The school of mathematical and computer sciences (SMCS) in the University of Limpopo uses a manual form for collecting and storing student complaints, but this manual complaint system has resulted in many setbacks such as delayed responses. A computerised student complaint (CSC) system is a web-based application designed for the SMCS to provide an online way of solving problems faced by students. The CSC system is designed by incorporating students' inputs gathered during a survey conducted in the beginning of the study. The developed CSC system has students' side and administrator's side. In the students' side, students can post their complaints and view the responses while in the administrator's side the administrator's task is to view students' complaints and inform responsible people through their emails. After designing and developing the CSC system, the subjective testing method was carried out. With 50 participants randomly selected to take part in the testing. The areas of focus in the tests were: functionality, performance, user-friendliness, and graphical user interfaces (GUIs). The results show that most students believe that the CSC system is fairly usable and acceptable.

Keywords: *Computerised Student Complaint (CSC) system, Functionality, Performance, User-friendliness, Graphical User Interfaces (GUI)*

Introduction

A computerised student complaint (CSC) system is a web-based application that is designed to make the process of resolving a complaint made by students. Academic growth can be of various concerns in an academic environment to promote the social and functioning educational system (Project topics, 2018). For an effective educational system to take place there are some issues in an academic environment that should be properly addressed, issues such as complaint handling. Schools are intending to give a system by which students may lodge a complaint with respect to an administration or scholarly experience at the school. Through this procedure, the schools look to guarantee quality education and incredible help for students. Further, the procedure is expected to recognise changes to improve administration and students' fulfilment, just as to show consistency with government guidelines in regards to the receipt, reaction to and following of students' grievances (College, 2019).

The Student Affairs Department of the University of Uyo discovered that there exists a manual form for collecting and storing student complains at the University of Uyo (Research Clue, 2018). According to College (2019) manual complain record keeping has resulted in many setbacks. The setbacks encountered include time wasting, exposure of confidential matters and partial or total loss of files or documents. Some universities' complaint procedures often work against the students, in cases of delayed response. Universities regularly take more than a year to deal with complaints, which result in delayed feedback because there are no deadlines (Shepherd, 2009). The University of Limpopo also uses manual complaint system and which results in setbacks such as delayed responses.

Aim

The aim of the study is to develop a web-based student complaint system for the school of mathematical and computer sciences.

The objectives of this research work are outlined as follows:

- To gather students' inputs on the proposed CSC system.
- To develop the proposed CSC system.
- To test the developed CSC system using a subjective testing method.

Related work/literature review

Looking more specifically at the change drivers in the field of complaints and appeals there has been an increase in student awareness of consumer rights and a widely debated move to a complaints culture (Buckton, 2008). This shift is not necessarily being fuelled so much by tuition fees issues as by students gaining increased knowledge of their rights: if a service is provided for a fee, then it should meet the expectations of the user. The delivery of higher education is different from the provision of most other services, in that (as with a gym) the process requires quality input from the consumer in order to succeed. Institutions aim to provide a quality service but recognise that sometimes things can go wrong with the partnership. For instance, problems can start when a student decides to put the blame for poor examination results on their institution, rather than on their own lack of ability or organisational skills.

The concept of student complaints has often been incorporated into wider investigations of service quality (Hart & Coates, 2011). However, students express their dissatisfaction with their University in different ways. The smart complaint management system application developed by Radhakrishnan et al. (2016) allows users to just launch their complaints from anywhere with the help of mobiles. Users can capture an image or upload videos as their complaints and even use GPS facility which will be provided so that users' location can be tracked easily. The online complain system by Tiwary, Aditya and Hussain (2017) allows the user to lodge a complaint by sending a document while the admin can download and process the complaint. Students can complain through the website itself without going to the office and without queuing. They can even track the complaint and get to know about the employee who has been assigned the complaint. Also for the administrator as well as the employee they could easily give the details.

Wittenberg University (WU) maintains a systemic approach to students' complains. Various types of students' grievances and appeals are handled by multiple processes and departments. They also have General Student Complaint Form: If a complaint is not addressed students are advised to complete the General Student Complaint Form. Once the form is submitted, an automatic email is generated to the Student Complaint Panel (Office of student development: Student complaint system, 2019). The Vincennes University (VU) has an Online Student Complaint System in place. Students are encouraged to always attempt to resolve any problems with those who are involved. Dealing with concerns in a direct and honest manner should be the first step in resolving the problem. However, if an issue cannot be resolved, students are advised to use the VU Online Student Complaint System (Student complaint process, 2019). The systems provide a better way of solving students' problems which reduces time, eradicate corruption and allow students to post as many complaints as they want (Nasr & Alkhider, 2015).

Computerised complaint systems are useful for people to file a complaint with the help of web-based application (Radhakrishnan et al., 2016). Responsive is about how quickly you

respond to a complaint and complainants. It is a question of receiving, recording and responding to a complaint, of looking at the problems that it poses and how best to handle them, of taking decisions and of informing the complainant of the progress and ultimate decision (Sultan, Abidin, & Abdullah, 2008). The systems are capable of recording many complaints and the admin can also give feedback for each raised complaint faster (Manuhutu & Uktolseja, 2018).

Motivation

The CSC system enables proper complaints submission and control. Such systems serve well than the existing manual systems which are used in most universities (Project topics, 2018). Some universities do not have a deadline in giving students feedback, the CSC system is expected to save time, be user-friendly and improve relationships between all stakeholders in place. In the SMCS at the University of Limpopo, there is no CSC system in place. As such, the study is motivated by the lack of such a CSC system.

Sampling

A sample of 50 students from the SMCS is randomly selected to participate in a survey on a voluntarily basis. Authors have chosen to use a sample dimension of 50 students, as the research has only two separate variables and the simple rule would be that a sample dimension of a minimum of 20 (Statistics Solutions, n.d.), 25 males and 25 females were randomly selected. A different group of 50 students from the same school is randomly selected as well to participate in the testing of the developed system. The criterion for the selection of the two groups is that the student should be currently registered at the University of Limpopo and for a degree offered by the SMCS.

Data Collection

A questionnaire is used to collect data in this study. The questions asked were closed-ended and the participants were given an opportunity to give any comment at the end. This type of questions enables participants to simply select the option(s) that relates to them and it is easier to complete. The survey aims to collect the insights from students into the CSC system and to integrate students' input into the CSC system design stage.

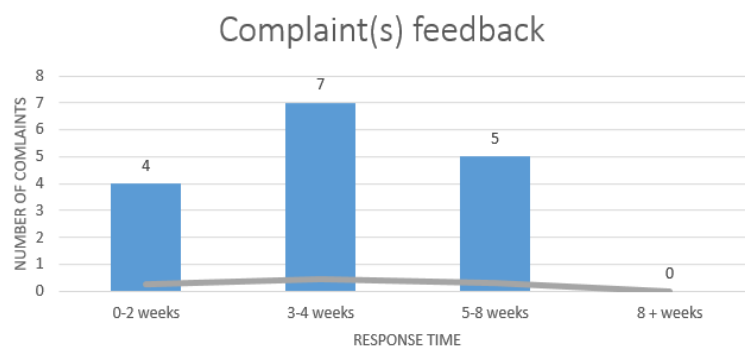


Figure 1: The time taken for the school to give feedback.

Figure 1 demonstrates the duration it took the SMCS manual complaint system to resolve a complaint. It indicates that of the 16 students who filed a complaint, 25% of the complaints were resolved within two weeks. At least 44% of the complaints took 3 – 4 weeks to be resolved and 31% of the complaints took 5 – 8 weeks to be resolved. These results show that complaints in the school can take up to 8 weeks to be resolved. The students were also asked about the need for a system such as the CSC system and, 70% of them think that the system is

required. It is only 18% of the students who think the CSC system will not make any change to the school while the remaining 12% are unsure of the need of CSC system.

Methodology

This section looks into the development of the CSC system, its functionality and interfaces. We discuss some of the key interfaces that performs the core functions of the system. Figure 2 shows the home interface of students after they are logged in and students can view their complaints in this interface as well as access settings to their accounts, lodge claims, history of complaints and also logout.

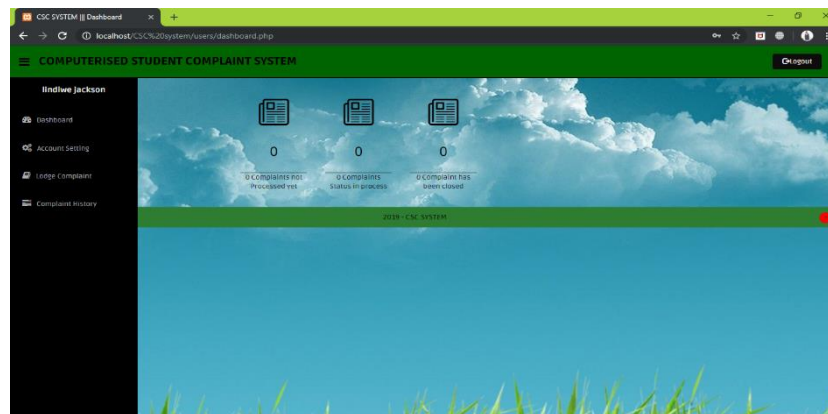


Figure 2: The user homepage interface.

Figure 3 shows the interface for complaints, where students can fill out the form and upload any supporting document. Students can also access the sidebar menu to view the dashboard, access account settings, and view complaint history.

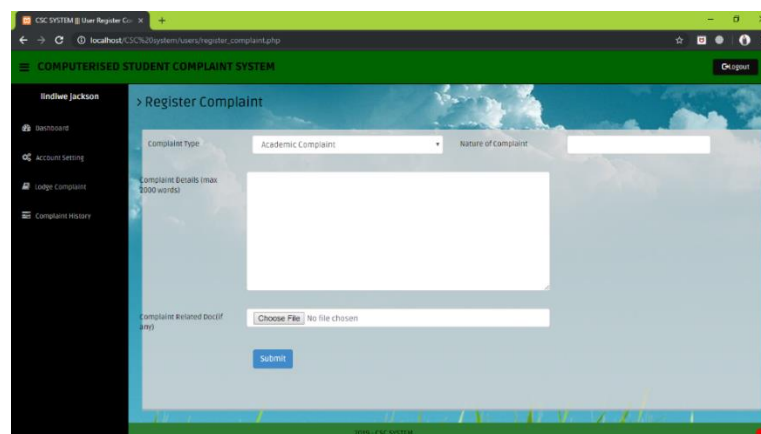


Figure 3: The complaint form interface.

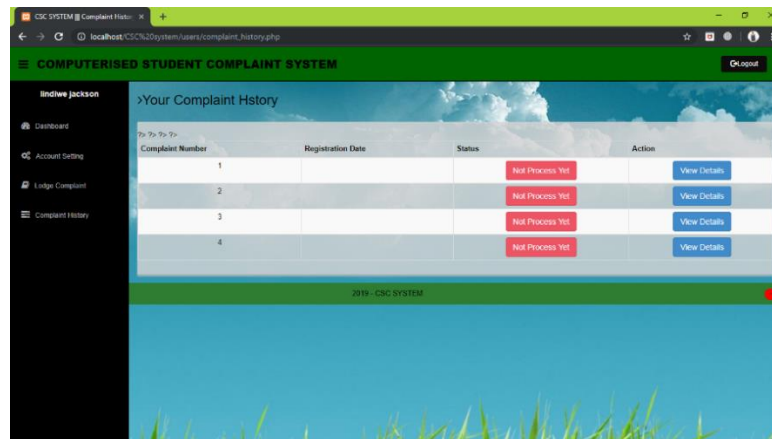


Figure 4: The complaint history interface.

The historical interface of student complaints where student history is viewable is shown in figure 4. Students can view their complaint details, statuses, registration date, and complaint number.

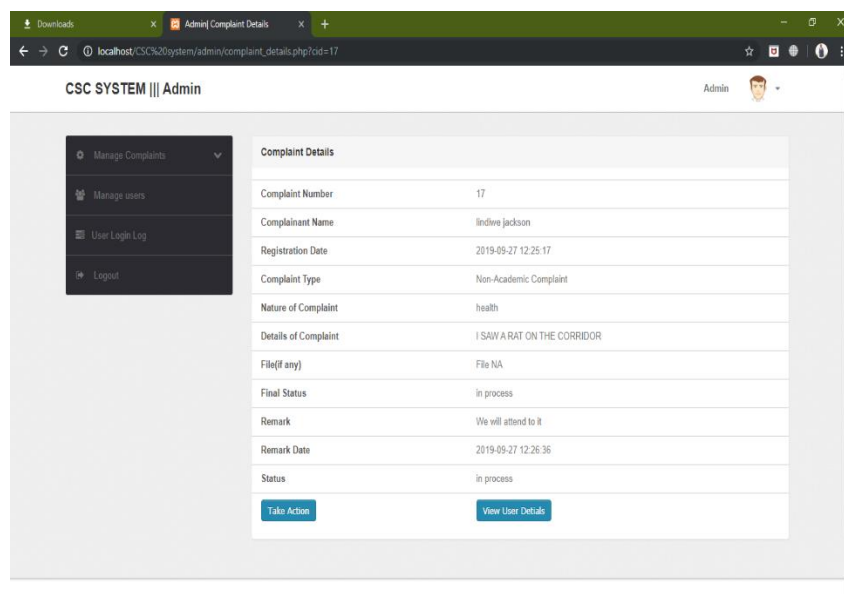


Figure 5: Complaint details interface.

The interface for complaint information is shown in figure 5 where the administrator can view complaints in detail and view information of the students who submitted a complaint. After viewing the complaint(s) information and consulting accountable persons, the administrator can update the student(s) on the subject by pressing the action button.

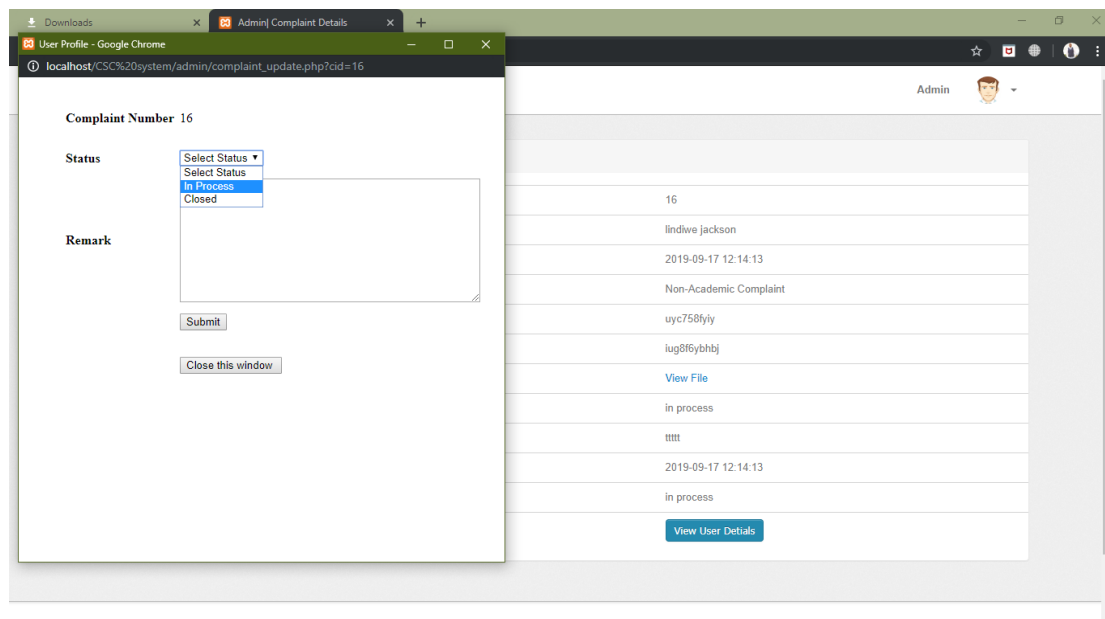


Figure 6: The remark interface in the administrator's side.

Figure 6 demonstrates the form the administrator must fill out to provide students with feedback on their complaints. The Administrator can select complaints status and type a message in remark textbox to give feedback to students. Figure 7 demonstrates the user's management interface where the administrator can view a list of students using the CSC system and view their information and delete their student account.

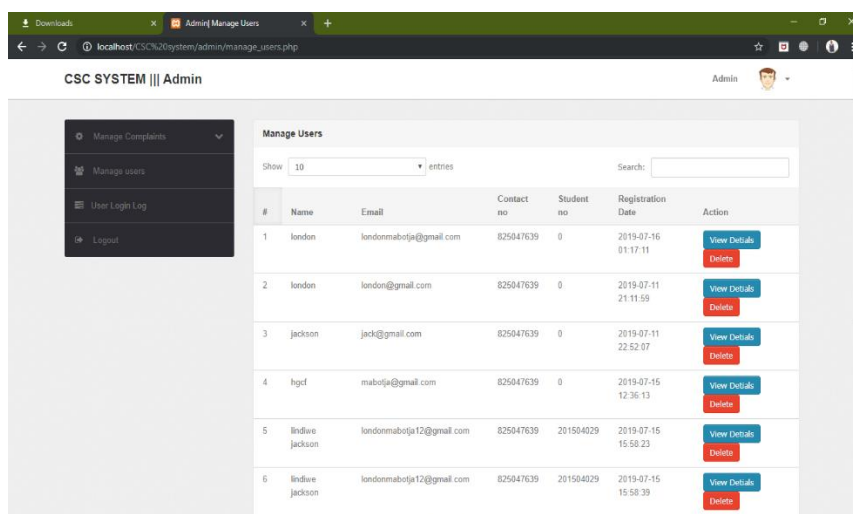


Figure 7: Students' details on the administrator's side.

Findings

The developed CSC system is tested through a subjective method in which 50 randomly sampled participants who are students at the University of Limpopo were given the CSC system to use and asked to complete a questionnaire thereafter. The participation was solely based on voluntarily of the participants. The CSC system testing is based on the system's functionality, graphic user interfaces (GUIs), user-friendliness and performance. The participants had to rate the system on a 5 – point scale, where 1 – very poor, 2 – poor, 3 – average, 4 – good and 5 – very good. The participants were asked to score each aspect tested after using the CSC system and they were also afforded a space to give any feedback or

comments at the end of the rating section. Figure 8 shows the findings of the CSC system in all the tests conducted. A mean opinion score (MOS) technique was adopted to validate the participants' feedback. This technique determines the mean or average of the scores to determine the opinion of the participants in each aspect.

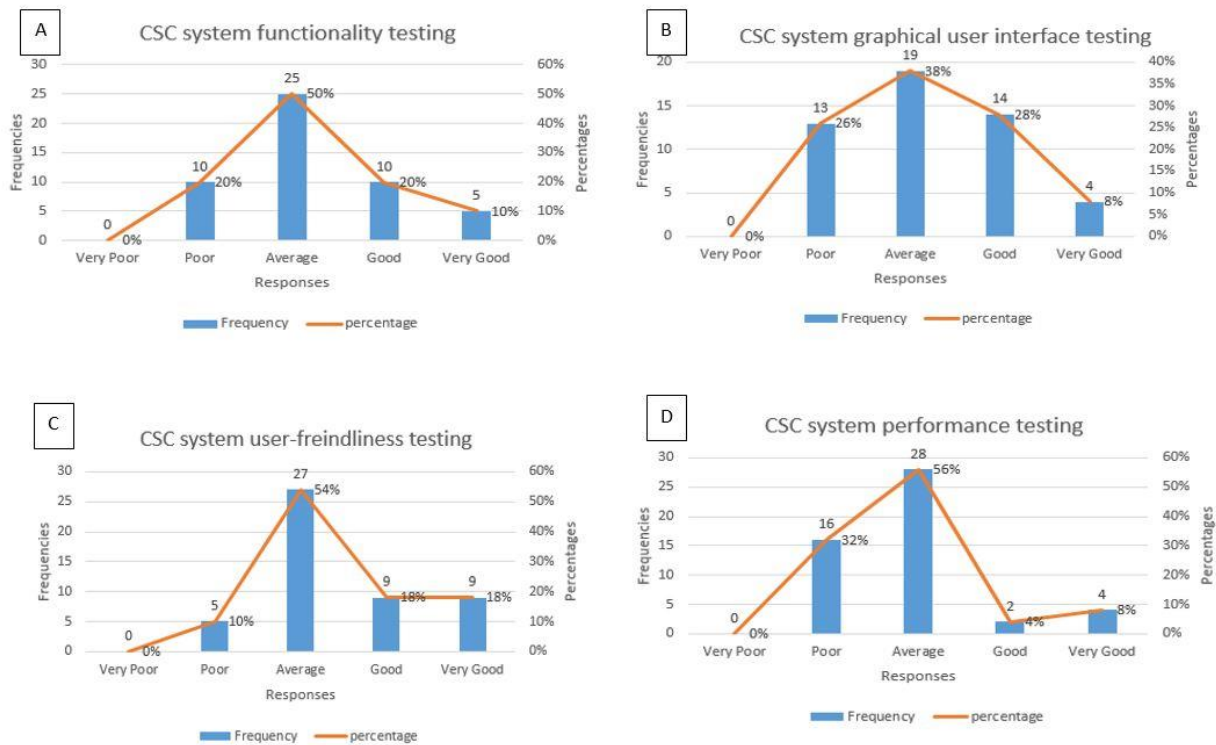


Figure 8: The CSC system testing results for functionality, graphic user interface, user-friendliness and performance.

As shown in figure 8A, 20% of the participants scored the CSC system poor in terms of its functionality. And most of the participants (50%) indicate that CSC system's functionality is average, with another 20% saying the CSC system is good. Ten percent scored the CSC system very good for its functionality. The results in figure 8A portray a general acceptance of the CSC system for most respondents (80%) with a score of at least 3 (average). The results of the GUI test are shown in figure 8B. The figure shows that 26% of the participants scored the CSC system poor and another 38% of students say that the GUI is average. Twenty eight percent indicates that the GUI is good, with at least 8% indicating that it is very good. These findings also show a positive attitude (with average to very good rating) to the system for most respondents (74%) in terms of the GUI. Figure 8C reveals that 10% of respondents rated the CSC system poor for its usability, and 54% saying that it is average in terms of user-friendliness. Eighteen percent of the respondents say that the system is good and another 18% think the system is very good. These findings mean that the majority of students (90%) have rated the system average to very good in terms of its user-friendliness. According to figure 8D, a significant number of respondents (32%) say the system is poor in terms of performance. While majority (56%) are saying the performance is average. Only 4% suggest that the system's performance is good while 8% think that the system's performance is very good. These findings show a positive attitude to the CSC system by most respondents (68%) in relation to performance.

Discussion

In terms of the functionality, performance, user-friendliness, and GUI test results, most students (80.5%) believes the CSC system is acceptable. The study also found that the effectiveness of the CSC system is much better than the manual complaints system. The CSC system is shown by participants' perceptions after using it, that at least 50% of participants had a positive attitude towards the system in terms of functionality, usability and performance. The positive attitude in terms of functionality, usability and performance towards the CSC system is a good indication that the system can be deployed in the SMCS. Although the system received some poor rating for all the tests (average of 19.5%), it is pleasing that there is no test that received a very poor rating.

Other students made suggestions on what should be added to enhance the capability of the CSC system. Some students mentioned that – “the CSC system should provide an option for students to select their level of study and modules, so that the system can automatically assign cases to employees based on the modules”. They also suggested that – “the system should automatically email proof of complaints to complainants”. The two key tests, functionality and performance are the most important test as they measure how the system performs its function. Having recorded great scores (above 50%) it clearly indicates that the system is achieving its purpose. Even though there is a worrying group that rated the CSC system poorly for both functionality and performance with 20% and 32%, respectively. The test that scored the highest rating is the user-friendliness, with a significant number (90%) of the participants saying that the CSC system is at least average.

Future work

As part of the future work in this study, the authors recommend a complaint system that also provides the capability to immediately email proof of complaint to the complainant. Since the study only focused on the SMCS at the University of Limpopo, there is a need to further extend such complaint systems to other schools within the university and to high schools.

Conclusion

In this paper, authors discussed the importance of computerised complaint system. How institution of learning can benefit from such systems. Authors also developed a computerised student complaint system as a solution to a manual complaint system to the school of mathematical and computer sciences (SMCS) at the University of Limpopo. Prior to the development, a survey was used to gather students' ideas about what can be included in the design phase of the computerised student complaint system. A random sample of 50 students in the SMCS was recruited on a voluntarily bases to give their experience with the current complaint system in the school. The computerised students complaint system was then developed taking into account the inputs from the survey.

Authors then performed subjective testing in which another 50 students/participants from the SMCS were given the system to use and they were then expected to complete a survey thereafter. The subjective test involved testing the CSC system's functionality, graphic user interface, user friendliness and performance. The participants scored the CSC system using a 5-point scale where 1 – very poor, 2 – poor, 3 – average, 4 – good and 5 – very good. The mean opinion scores was then used to determine the acceptability of the CSC system. The results and analysis of the survey are presented in detail in the results section. All the tests scored greatly on average and the results show that the developed CSC system is acceptable to most students in the SMCS.

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SOUTH AFRICAN NATURAL SCIENCES TEACHERS' PERCEPTIONS REGARDING THE IMPLEMENTATION OF SELECTED ELEMENTS OF A NEW CURRICULUM

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Abstract

This paper reports on South African Natural Sciences teachers' perceptions regarding the implementation of selected elements of a new curriculum in one province. This paper focuses on teachers' perceptions of Curriculum Assessment Policy Statement (CAPS) through their awareness and interpretation as well as how they use the selected elements of CAPS. This study followed the qualitative approach. Data were generated through lesson observations, artefacts and a semi-structured interview with 10 Natural Sciences teachers (n=10) purposively selected. These sets of data were triangulated to solicit teachers' perceptions and their interpretation of the selected elements which guide their classroom practices when implementing CAPS. Data were analysed using thematic analysis. The findings of this study revealed acceptance of CAPS by Natural Sciences teachers. Though their interpretation of the selected elements slightly varied, a great deal of common practices in the implementation process was evident. This implies the gradual realisation of the intentions of CAPS among the Natural Sciences teachers of South Africa. Despite all odds, this study found that there is prevalence of willingness among South African Natural Sciences teachers to effectively translate CAPS' expectations into reality. The study recommends needs analysis ahead of new reform implementation for Natural Sciences teaching in order to minimise operational challenges and ensure positive reception of curriculum updates.

Keywords: *Teacher perceptions, Selected CAPS elements, Natural Sciences teachers, Curriculum implementation, Curriculum interpretation.*

1.1 Introduction

There is an imperative need for regular curriculum update that is adequate, relevant and coherent so as to keep pace with the changing global situation (Kanamugire, Yadav, & Mboniyirivuze, 2019; Rwanda Education Board, 2015). According to Park and Sung (2013), over the last few decades, many countries have made significant efforts to implement curriculum reform. However, the implementation process for many countries has never been smooth sailing. Teachers' beliefs and perceptions has always been the last to consider by curriculum developers. This in Park and Sung's (2013) view would be wrong to expect teachers to accept and implement curricula faithfully in a way intended by developers without taking into account the meaning they attach to the reforms. Such meanings determine their acceptance and rejection of revision (Maharajh, Nkosi & Mkhize, 2016). Thus, if teachers' viewpoints are not incorporated in curriculum implementation, it becomes a mismatch between the official curriculum prescribed by the curriculum developers and the actual curriculum taught by teachers in their classrooms (Cuban, 1993). Park and Sung (2013) further point out that teachers are key to curriculum reform success, therefore their knowledge, belief and perceptions play a fundamental role in the effective implementation of reforms. South Africa is among the countries that have recently implemented its fifth curriculum reform, CAPS to be specific. As such without finding out what perceptions teachers hold of this reform, would be a recipe for disaster. Thus the rationale for this study is to explore Natural Sciences teachers' perceptions when implementing the selected elements of CAPS in particular and the new reform in general.

1.2 Statement of the problem

South African curriculum design and development is still stuck to the top-down approach as curriculum policy statements are decided by officials above teachers and implemented by the teachers (de Clercq, 2020). The Persistence of South African Educational Inequalities: The Need for Understanding and Relying on Analytical Frameworks. *Education as Change*, 24, 1-22). CAPS as a review from the previous four versions, was introduced with understanding that it will minimise the challenges that were identified from its predecessors, such as having little or no guidance for daily operational plans. It is described as a streamlined curriculum meant to guide teachers in a much easier way as it encompasses content and concepts together with the assessment activities required and when they should be done. This idea resonates well with Janik, Janko, Peskova, Knecht and Spurna (2018) who indicate that often curriculum reform is promoted as promising improvements in the quality of education. However, Stibbe (2005) cautions that if success is to be ensured, it is vital that the nature and principles of the reform are understood and accepted by those implementing them. As such, this study taps into teachers' views to gauge their perceptions in implementing the selected elements of CAPS as there is a need to explore their beliefs, views and experiences. Ramnarain and Fortus (2014) argue that teachers require a great deal of support for them to implement the changes of the new reform as required. Since all these reforms advocate that classroom practices in the implementation process need to meet the required standards of the new curriculum, this study takes a leaf from the latter and its rationale on the premise that changes in the new reform are difficult to surmount without sufficient support and guidance. As South Africa has updated its curriculum, in the same vein it is not immune to challenges identified globally in implementing a new curriculum hence review of pertinent literature indicates that this is a difficult and challenging area yet to be explored, justifying therefore the undertaking of this study.

1.3 Review of related empirical studies

A close look at the new curriculum implementation reveals that teachers all over the world are faced with similar challenges when implementing a new curriculum. For instance, from their study on implementation of the revised 2013 Lower Secondary Science (LSS) curriculum, Wong, Lau, Lim, Teo and Lim (2015) found out that teachers in Singapore encountered various constraints and tensions when implementing the new curriculum. Similarly, Park and Sung (2013) concur that in such occurrence, teachers generally viewed curricular reform as extra work, and they showed little motivation to implement it. In their study, teachers' perceptions of the recent curriculum reforms and their implementation, Park and Sung found that Korea teachers had questions with regard to the reform ideas during the implementation process, regrettably it was difficult for them to get help and support.

Similar sentiments are echoed by Kirkgoz (2008) in her study on curriculum innovation in Turkish primary education. She identifies that most factors that make it difficult for teachers to implement new curriculum successfully are teachers' lack of understanding of classroom applications of the proposed change, their background training and lack of guidance and support. The same observations are noticed by Fu and Clarke (2017) in their study focussing on individuals and collective agencies in China's curriculum reform. They submit that teachers understood the intentions of the reform but lacked practical skills for implementation. In Iran, Chaharbarshloo Gholami, Aliasgari, Talebzadeh, and Mousapour (2019) from their study on analytical reflection on teachers' practical knowledge focusing on exemplary teachers in an educational reform context lament that though government introduced the new reform with changes in curriculum, merging the teachers' role and

instructional methods all under constructivism, the reality of the matter is that practices are still positivistic. This is indicative of the importance of continuous teacher empowerment alongside new reform implementation to ensure effective and uniform practices.

Impediments in implementing the teaching and learning of science as they should are noted by Brodie, Shalem, Sapire, and Manson (2010) who pinpoint that factors such as teachers' inadequate training often widen the gap in the pedagogic practices such as teaching and assessment, and create varied classroom practices amongst teachers of the same subject in the same phase. Awofala, Ola-Oluwa, & Fatade (2012) assert that for easy implementation of the curriculum in schools, efforts toward teachers' capacity building on the use and selection of instructional materials, and orientation as well as sensitization of teachers are paramount.

1.4 Purpose of study

This study thus explored Grade 9 Natural Science teachers' perceptions in implementing CAPS curriculum. Over and above, the investigation sought to establish senior phase Natural Science teachers' views of implementing selected element as required by CAPS curriculum in one district of the North West province in South Africa, and ways of averting stultifying challenges in the implementation of those elements of the CAPS curriculum.

1.5 Research Questions

- What perceptions do the Natural Sciences teachers hold in implementing selected elements (Time allocation, LTSM, Specific Aims, Content, Assessment, Annual Teaching plan, Science process skills and suggested activities) of CAPS?
- What are the grade 9 Natural Sciences teachers' views when implementing the selected elements of CAPS?

2. Conceptual framework

This study conceptualised teacher perceptions as beliefs and attitude that leads to their intentions towards their behaviour. A person's behaviour is determined by their intention to perform the behaviour as such the intention is, in return, a function of their attitude toward the behaviour (Fishbein & Ajzen, 1975). This study is premised on the construct, perceived behaviour control aligned with teachers' beliefs, and normative belief (belief strength and motivation to comply) as the focus is on teacher perceptions in the implementation of a new curriculum.

What teachers believe and their viewpoints of the curriculum matter most during the implementation process. This idea resonates with Park and Sung's (2013) defined meaning of perceived behaviour control, which means the degree of control individuals believe they have over an innovation. As indicated earlier, the top-down approach of South African curriculum design and development system has deprived teachers of curriculum autonomy for a long time. It is therefore important to note that if teachers perceive an innovation as being outside of their control, however positive their attitude towards it, they may not implement it as expected (Park & Sung, 2013). This is due to the fact that, behavioural control is the result of beliefs and attitude that reflect the positive and negative outcomes of the implementation process. Having been derived from attitude, it is their intention that will determines whether or not the curriculum expectations will be effectively fulfilled as required by the education system. One of the fundamentals of effective compliance to implementation of a new reform is professional development trainings (Bayar, 2014). Professional development may eliminate varied interpretation to implementation. Which is why Park and Sung (2013) recommend

teacher professional development as key to successful implementation of a curricular innovation.

3 Methodology

3.1 Research design

This qualitative study is exploratory, descriptive and interpretive (Creswell, 2013). The study utilised the constructivist interpretive qualitative paradigm to comprehend teachers' perceptions and experiences regarding the implementation of a new reform. This design was useful in gaining understanding of teachers' attitudes and beliefs towards a new reform (Park & Sung, 2013).

3.2 Sampling technique and sample

Purposive sampling was used to select 10 Natural Sciences teachers. They all teach Natural Sciences at Grade 9 level, belong to the same district and are all qualified to teach Natural Sciences.

3.3 Research instruments

Lesson observation schedule and semi-structured interview together with artefacts were utilised to collect data. The interviews were preceded by lesson observations to get the sense of teacher quality and the classroom practices as transpired. The lesson observations happened during normal school time while interviews were conducted during teacher's free time on the same day. The observation reveals quite a number of operational challenges, more than that of pedagogy. Teachers' execution of their duty in class was cluttered by contextual challenges that arose from the implementation and delivery of curriculum. Soon after lesson observation, one on one interviews were conducted which assisted with immediate discussion of what was observed.

3.4 Data analyses techniques

Qualitative data analysis was guided by an analytical tool adapted from Attride-Stirling (2001) known as Thematic Networks analytical tool. According to Attride-Stirling (2001) applying thematic networks is simply a way of organizing a thematic analysis of qualitative data. Thematic analyses seek to unearth the themes salient in a text at different levels, and thematic networks aim to facilitate the structuring and depiction of these themes. Analysis of lesson observations and interviews followed Attride-Stirling's tool.

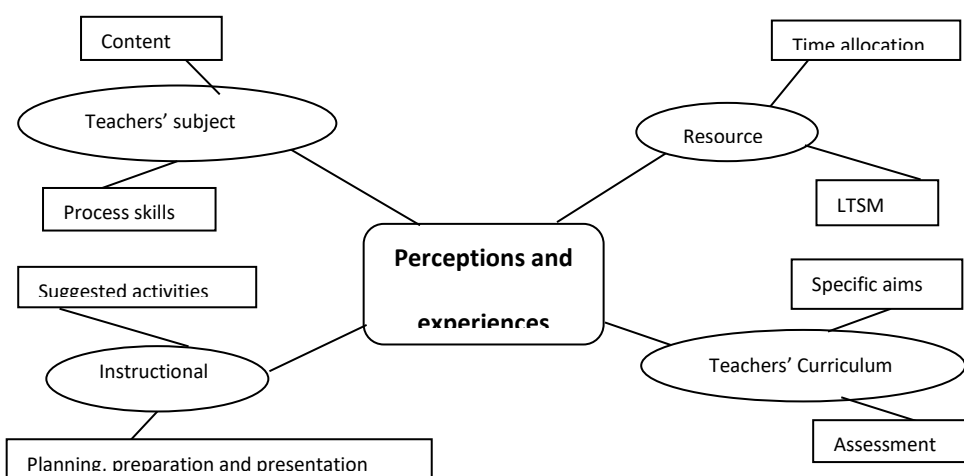


Figure 1: Thematic Networks: Analytical tool for qualitative research adapted for this study from Attride-Stirling (2001)

3.5 Trustworthiness

Trustworthiness is described as bedrock of high-quality qualitative research (Birt, Scott, Cavers, Campbell, & Walter, 2016). This study ensured reliability and validity through a number of quality measures (Merriam, 2002). Those measures include credibility, transferability, trustworthiness and confirmability. For the purpose of determining credibility, the two experts other than the researcher independently scrutinised the contents of the lesson observation schedules and the interview protocols for reliability purpose. This process reduced potential bias by the researcher and enhanced the credibility of the results. Different data sources were used in order to improve the trustworthiness (Cohen, Manion & Morrison, 2011). Participants in this study were drawn from across the district including both the rural and semi-urban schools to enhance transferability of findings. Lastly, this study achieved the confirmability of findings partly through triangulation and member checking. The recordings from lesson observations and interviews were immediately played for teachers to confirm the data collected.

4 Results

The selected elements were thematically analysed individually. The following were the themes:

4.1 Resources

Time allocation & Learning and Teaching Support Materials (LTSM)

Teachers were asked: Is time allocated (10 weeks) for a school term enough to teach and complete the content allocated? Though majority (8 of the 10 teachers) found 10 weeks for the term sufficient to teach content, 2 of the 10 expressed waiting for resources (chemicals or apparatus) as a cause of delay for progress in completing the term syllabus. This forces teachers to device means for extra time after school so as to complete a practical and its assessment. All 10 respondents who were interviewed lamented on the two weeks revision that they have lost due to examinations that come earlier. The unavailability of time for revision was clarified by one teacher during the interview as follows:

Last two weeks of revision are usually taken away by the early start of the examination. Usually as soon as the FET examinations begin, all the classes are stopped because all teachers have to invigilate. This narrative suggests that majority of teachers find it necessary for learners to be engaged in revision before the exams commence, and the fact that curriculum implementation is interrupted by operational constrains.

4.2 Teachers' subject matter knowledge

Content & Process skills

Matter and Materials is a knowledge strand that exists in both Physical and Natural Sciences that requires teachers to be conversant with the Chemistry content which is embedded in the two school subject mentioned above. However, due to contextual factors prevalent in schools, such as shortage of science teachers, some schools operate Natural Sciences with teachers who did not specialise in Physical Sciences. For instance, a teacher who specialised in Geography and Life Sciences, cannot be allocated to teach Natural Sciences without some support. This is because the teacher might not be conversant with Physics and Chemistry concepts but can teach the other two strands of Natural Sciences which are Life Sciences and Geography. Unfortunately, the learners will leave the senior phase to join the FET phase with

no knowledge of Physical Sciences concepts and science process skills, thus perpetuating poor performance in the subject that is consistently poor performed in the FET as projected even by international research (Trends in International Mathematics and Science Study and Progress in International Reading Literacy Study). As such, teachers are at times caught in between rescuing the school and betraying the system.

During the interview a teacher who did not specialise in Physical Sciences and was observed regurgitating a textbook during lesson presentation due to superficial knowledge of the topic ‘chemical reactions’, that teacher had this to say:

I was not trained in Physical Sciences, so certain topics yeah, they are a challenge and at the same time interesting to me, but I am managing and I will get there. This teacher was one of the three that did not specialise amongst the 10 respondents who were interviewed. However, for this teacher to show interest and express that “I’m getting there” shows willingness to be developed. Moreover, one school had assigned a teacher with no science background to teach NS in grade 8. From a different school, another teacher expressed his understanding of the significance of imparting science process skills when teaching content as follows:

... because Natural Sciences is a practical subject, we live it, so whenever I teach, like for instance as I was teaching the Grade 8 they were doing diffusion and dissolution of substances, so I told them whenever you make your tea in the morning look at the way the tea flows from the teabag in the water, that is diffusion and when you add sugar and stir, that is dissolution... Both these comments show willingness and adaptability of teachers, even in the face of lack of content specialisation.

4.3 Teachers’ curriculum knowledge

Specific Aims and Assessment

Teachers’ curriculum knowledge enables them to guide learners in asking scientific questions, engage in investigations and link science to the environment in general. From the interview session, the following question was asked; ‘how do you incorporate specific aims in teaching content and what do the specific aims imply in your teaching?’, the response started by first mentioning the three specific aims in Natural Sciences followed by:

The (specific aims) make us teach conscious of the level of content knowledge required per grade and linking science to society. This response is indicative of how well informed the teachers are when it comes to curriculum knowledge and related matters, such as knowing the Specific Aims enlisted in CAPS document and what they imply in teaching and learning of Natural Science.

Assessment is an integral part of teaching and learning which teachers expose the learners to establish the progress learners have made in a particular period of learning. This is done using different methods stipulated by the education policy. The interview question (which assessment strategy do you find suitable to assess topics of Matter and Materials?), revealed that teachers use variety of assessment strategies to assess this knowledge strand and also understand the importance thereof. In fact, a number of responses emerged, e.g. one teacher said;

“the strategy I use is question and answer with discussion. I used the same for the first term strand. It’s also because of no resources were available, if there were resources, I could have done some experiment and see if it works better”. A follow up question during interview was,

‘what makes this particular assessment strategy(ies) suitable for this strand according to you?’ One of the teachers responded:

I like it because most of it is verbal and help me to notice the weak learners faster, even though it is not good for those who can't express themselves, like that one you saw in class, but when it comes to writing, he's always good. The participants' responses indicate that teachers are aware of the purpose of assessment in the implementation of CAPS curriculum while acknowledging the lack of resources to conduct experiments. They have accepted the assessment tasks and methods as suggested in the CAPS document.

4.4 Teachers' instructional knowledge

Planning, preparation and presentation & Annual Teaching Plan (ATP)

This is the crucial part of teaching and learning in which the teacher has to exhibit the appropriate skills for effective teaching and learning. Interviews revealed that teachers plan, prepare and present the lessons differently for different reasons. When asked; ‘what teaching method/strategy do you rely on most and why?’ one teacher responded:

I would say.... I rely mostly on chalk board, but it is because when you just talk, these learners don't even write anything, so I encourage them to write because they say when I talk I am too fast... Despite all the challenges they may encounter, participants do plan and prepare before going to class. Interestingly, each one of them had a written lesson plan that indicated that learner-centred approach as the teaching method.

Annual teaching plan is a new term for work-schedule. It is the arrangement of topics by school term and weeks which teachers can break down into daily plans. In it there are topics and concepts relevant per term for each grade in each phase or band. On this theme, when asked what she thought of the Annual Teaching Plan layout and she said:

I actually wish the GET time for the lesson was the same as that of FET, one hour. The content would be good if we did not have too many topics. Right now, we have to touch here touch there, it doesn't make sense for the learners, ... On the same question, another teacher said:

I start the lesson with question and answer, that's because I am trying to save time for the many topics that we are supposed to finish. So topics in the Annual Teaching Plan are flowing well, but many, so you take time to finish. Both respondents tried to fulfil curriculum demand despite insufficient time to cover the required topics.

The observation did not reveal much about the Annual Teaching Plan layout, but all lesson plans correlated with the Annual Teaching Plan as contemplated in the CAPS document, meaning that teachers followed the correct strand and its topics for the term. Generally, the majority of the participants accept the Annual Teaching Plan layout as it is. The results on the organising themes and their basic themes in this section indicate that teachers have accepted CAPS curriculum. Currently, implementation appears to be well executed. Teachers uphold the policy as expected. Their use of CAPS document for planning and preparing, choice of teaching methods, use of variety of assessment strategies provide a clear picture of the teachers' acceptance of CAPS curriculum.

5 Discussion

The first question focused on senior phase Natural Sciences teachers' perceptions in implementing the selected elements of CAPS curriculum. Gathering from data analysis, the organising theme and their basic themes presented in this research question, revealed that Natural Sciences teachers have accepted CAPS. Though they have voiced their challenges of inadequate time and resource availability, their commitment to fulfilling the requirements of curriculum remain positive. This is consistent with Awofala, et al. (2012) finding that in Nigeria teachers had high perceptions of the Mathematics new curriculum, while Erss (2018) found that Estonia, Germany and Finland teachers though with reservation had accepted their new reform because unlike Nigeria and South Africa, they have ownership of curriculum. In Lim and Pyvis's (2012) study, it emerged that the science teachers endeavoured to overcome the challenges to achieving their priority objectives by individually adopting measures to improve teaching and learning. This is why teachers continue to improvise and maximise with the little they have for the sake of their learners, that is, ensuring that their learners have at least photocopies or they can watch a demonstration lesson from the teacher, thereby complying with the requirements of syllabus coverage at the least.

The second research question explored teachers' views on implementing selected elements CAPS. From lesson observations and interview results, it can be inferred that teachers have adequate subject matter knowledge, that is the 'what' of the new curriculum, however, they still struggle with the 'how' of implementation. For example, Fu and Clarke (2017) lament that teachers in China have an understanding of the new reform policy however, they lack the skill to apply their understanding. This was evident as majority of teachers found it difficult to select relevant teaching strategy particularly when teaching by means of experiments, they rather attempt a trial and error method and learn as they teach. In most instances they avoid being 'Knowledge-Transmitter' at all costs. This is indicative of their acceptance and positive views of the curriculum. Thus, Lim and Pyvis's (2012) affirmation that classroom practices and roles science teachers assume as well as the approaches they use to teach their science subjects are indicative of their will to carry out policy. Moreover, empirical evidence, indicate that teachers view new reforms challenging but interesting at the same time (Kirkgoz, 2008), as such lack of understanding of classroom applications of the proposed change, seems not to deter them from their endeavour. What they require in order to implement curriculum effectively is developmental training and support (Kirkgoz, 2008). This finds resonance with Awofala, et al. (2012) argument that for easy implementation of the curriculum in schools, the system needs to make effort to capacitate teachers so as to comply with and interpret the reform accordingly, failing which, the end products will be of varied qualities.

To summarise the findings on teachers' perceptions about CAPS curriculum, it is important to initially remind the reader that CAPS curriculum is more than five years in implementation. Therefore, teachers can make a clear comparison between the current (CAPS) and the three revised versions of the past curricula. Though the teachers received CAPS curriculum, it was found that amongst the four organising themes used to solicit their perceptions, the most negatively influential has been the inadequate resources (LTSM & time allocation). Lack of material resources is a general concern amongst teachers which was underscored by the findings of this study. Lim and Pyvis (2012) also found that insufficient time and lack of resources are commonly cited by researchers (for example Cheung, 2008; Braund & Driver, 2005) as the major obstacles towards implementing curriculum changes. From their study, Lim and Pyvis further acknowledge that science teachers 'deal with' these challenges through 'Pedagogical Adaptation' and 'Resource Consolidation' respectively.

Over and above resources, this study highlights the ripple effects of insufficient time allocated for practical lessons on other themes like instructional knowledge (Annual Teaching Plan & planning, preparation and presentation). From the teachers' lesson plans, it was evident that the choice of teaching strategies matched the aim of the lesson even though that could not be put into practice. The mismatch between planning and enactment emanated from time constraints. This can be attributed to the top-down approach employed by the education system when designing and planning curriculum. Pudi (2006) laments that teachers become the onlookers instead of being the designers of the curriculum. Molapo and Pillay (2018) concur by adding that after initiation of a new curriculum, policy-makers rush to have it adopted, without taking into account how the innovation is to be implemented. It is this haste that could have contributed to the view that teaching and learning remains compromised in South Africa. This explains the learners' low performance in science and maths confirmed by TIMSS and PIRLS.

5.2 Conclusion

This study outlined the perceptions Natural Sciences teachers hold in implementing selected elements of CAPS. From the findings, teachers have received CAPS curriculum positively though they still face a number of classroom challenges. Some of those challenges are influenced by contextual factors however, there is willingness to attempt implementation with the positive mind. The challenges such as those of teaching and learning resources together with time allocation put the department on the spotlight as they speak of the degree of support awarded to teachers both internally and externally. This appears to be left in the hands of teachers because over and above material resources, they also have to create extra time to complete the syllabus effectively. It is a great concern that, reform after reform, the story remains the same, lack of resources and support for teaching and learning process. Teachers still need to improvise or spend from their pocket as well as making extra time to comply with the laboratory practical activities and the syllabus completion in general. Though this is not unique to South African education system or Natural Sciences specifically, South Africa need to learn from other countries which succeeded in implementing new reform to produced envisaged product and take into cognisance the perceptions and views of curriculum implementers as that could be an indicator of whether implementation will succeed or not.

5.3 Recommendations

Support for teachers both in terms of resources and development be audited revised and addressed before the review of any curriculum update. This is a fundamental challenge from which most of the implementation problems emanate. Syllabus congestion as was highlighted by the teachers teaching both Grades 8 and 9 Natural Sciences be considered when shifting and reshuffling the topics from the higher grades as this impact negatively on curriculum saliency for the majority of teachers. It must be taken into consideration that effective science teaching requires enough time. Although this study found only one teacher appointed to teach Natural Sciences who had no formal training in science subjects, this could be a much common problem elsewhere in the country and should be looked into. The General Education and Training (GET) phase lays the foundation for the Further Education and Training (FET) science subjects, cases which attribute to teachers leaving out topics they cannot teach resulting in problems of persistent poor performance in Physical Sciences in the FET band need to be traced and rectified.

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THE TRAJECTORY OF SUPPLEMENTAL INSTRUCTION AS A TOOL TO SUSTAIN STUDENTS' ACADEMIC PERFORMANCE IN UNIVERSITIES

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Abstract

Academic performance of students in Universities is deteriorating as a result of a perceived lack of academic support from all stakeholders. This paper explores the implementation of supplemental instruction (SI) to enhance the academic performance of first-year students at university in South Africa. Social constructivism (SC) was used to theorise the study. At the same time, Participatory Research (PR) was adopted as the research design due to its beliefs of how research is conducted when it involves people. For data collection, an unstructured interview was used while thematic analysis was adopted to analyse the generated data. The participants for the study were first-year students, lecturers, tutors, and supplemental instruction leaders. This study unveiled the provision of educational facilities and proper planning as solutions to the challenges identified. This study recommends scholarly insights on first-year students' need of academic support from the relevant stakeholders in higher education and the benefits of supplemental instruction as a form of academic support to bridge the gaps in the academic performance of university students.

Keywords: *Student academic performance, Supplemental instruction, first-year students, Social Constructivism.*

Introduction

Teaching and learning in universities is described as the activities that take place in the classroom because of the way the environment is structured in order to achieve particular objectives (Sintayehu, 2018). This means that teaching and learning, which could be both formal and informal experiences are an integral part of any university (Kelemen, 2010; Muthusamy, 2015). Meanwhile, it was stated in a research conducted by West and Meier (2020) that challenge such as overcrowded classrooms is one of the problems associated with low academic performance of students in universities. The concept of teaching and learning in higher institutions of learning both globally and in South African requires urgent attention of higher education authorities if academic performances of students are to be enhanced. Nevertheless, the study bridged the gap by providing academic assistance in the form of Supplemental Instruction to enhance the performance of first-year students who are performing below average at universities. Health issue related problems have been associated with overcrowded classroom and lack of spaces to move around during tutorials (David, 2014). This means that for those students with health problems, it is difficult for them to be accommodated in the overcrowded classroom as this could cause more harm than good during tutorials. Furthermore, the inability of lecturers to move freely in the classroom because of the overcrowded classroom has been linked to the poor academic performance of first-year students (Adebola, 2019).

Therefore, this study believes that with the intervention of Supplemental Instruction, which is an academic support system, the academic performance of first-year students in universities could be enhanced. A lot of researches have been conducted on supplemental instruction in the areas like the comparison between students who attend SI and students who do not, the

effects of SI on academic performance. However, little or no research has been conducted on the use of supplemental instruction to enhance the academic performance of first-year students in universities. Hence, the aim of this study is to provide academic support in the form of SI to boost the academic performance of first-year students. Researchers like Jones (2013), Price, Lumpkin, Seemann & Bell (2012) and Mack (2007) in their reports have shown that SI does enhance the academic performance of students when comparing students who attend tutorial sessions with students who do not attend. Philip, Jacques, Jane & Kym (2014) defined supplemental instruction as that kind of academic support system used by higher institutions of learning to facilitate peer-learning sessions. This is done by recruiting the senior students who are in their 3rd and 4th year to tutor first-year students in a specific module. Supplemental instruction has been proven beyond an intervention but also as a method that benefits students with low, average and high prior academic achievement (Joakim & Lise, 2012). Supplemental Instruction in a research that was carried out by Etter, Sandar, Burmeister and Elder (2001), it was discovered that when comparing between a student who attended SI and who did not, it was confirmed that students who attend SI tutorials do perform significantly better than students who attend once awhile or who do not attend at all.

The problem of the Study

The problem of the study is linked to the low academic performance of first-year students. This was investigated by Ayala and Manzano, (2018) whose findings showed that some first-year students who could not cope with their academic were either dropped out or performed below average. Alami, (2016) also confirmed the fact that first-year students do find it difficult to cope in their first year and as a result leads to poor academic performance. All these points to the fact that the academic performance of students in universities could be jeopardised. Also, the researcher observed that despite the intervention of tutors at the particular university, the academic performance of students at this period seems unchanged, that is, the performance was still below expectation due to institutional challenges such as overcrowded classroom, lack of educational facilities and lack of proper planning.

According to Sibanda (2016), Mokhampanyane (2018), and Adebola (2020), clearly stated that the academic performance of first-year students calls for the intervention of SI as students do not perform well.). Hence, Adebola (2020) unveiled that supplemental instruction which is a type of academic support does enhance the academic performance of first-year students in universities. Meanwhile, Ning & Downing, (2010) after comparing the academic performance of first-year students who attended peer-learning support program with those who did not, discovered that students who attended the program performed better. The researcher, therefore, sees this as a problematic situation that needs to be investigated as the use of supplemental instruction will enhance the academic performance of the first-year students in universities. Therefore, the study's aim is to enhance the academic performance of first-year students through the use of supplemental instruction which is academic support.

Theoretical Framework

This study used social constructivism (SC) as a theoretical framework. The theory is deemed fit for the study because of its specific assumptions of how and where teaching is conducted. Vygotsky (1978), who is the founder of SC believed that the process of imparting knowledge should not be seen as a pragmatic approach. However, knowledge construction should be socially and collectively acquired both within and outside the classroom (Kim, 2001; Dagar & Yadav, 2016). This means that the construction of knowledge, according to SC should not

be associated with classroom teaching alone but rather extended beyond the frontiers of teaching and learning. Social constructivism is a theory that stresses the importance of learning in an environment that is influenced by cultural beliefs and assumptions in order to understand how learning is constructed based on the knowledge of what is taught (Kukla, 2000). Students should be allowed to learn either in a group or as individual as it is assumed that learning does occur in this manner. Collaborative work develops communication skills, enhances social interaction and lead to the development of critical thinking skills (Amineh & Asl, 2015). This is to say that, the focus of the theory is on what students learn and how they learn as of high value to Supplemental Instruction. Watson (2010) and Nzilano (2015) support the assumptions that students learn best in groups as they learn from each other. Thomas, Menon, Boruff, Rodriguez1 and Ahmed (2014), social constructivism is centred on individual learning that takes place as a result of the social interaction. This means that Social Constructivism theory places the learners at the centre of teaching and learning experience in this way, and in this way, meaningful knowledge is constructed.

This theory is relevant to this study because it helps the researcher to accomplish her goals in the sense that, with the assistance of tutors, students (tutees) can peer with their friends to learn from each other. Since the aim of the study is to enhance the academic performance of first-year students, adopting SC to theorise the study will help the researcher to achieve its goals in ensuring that students will have the opportunity to interact with one another under the supervision of a tutor. Hence, as students learn from one another and socialising, the study hopes academic performance of first-year students is enhanced. SC emphasised the importance of learning activities and how they are structured (Ning & Downing, 2010). In this study, SI session is about student learning collaboratively in a social context where tutors or lecturers are seen as facilitators.

Research Question

From the background of the study presented, the following research question and objectives were formulated:

1. How can supplemental instruction be used to enhance students' academic performance in universities?

Research Objectives

- To identify the challenges of using supplemental instruction in universities as a tool to enhance students' academic performance of first-year students.
- To suggest suitable solutions to the challenges of supplemental instruction as a tool to enhance students' academic performance of first-year students in universities.

Methodology

Research design

Participatory research (PR) as a research design was adopted for this study. Participatory research has been described as a type of research tool that is used to collect and analyse data and to generate new knowledge (Gillis & Jackson 2002). PR assumed that every participant who participates should be part of the decision-maker and action of the research. This means that the concerned people's voice should be heard at the end of the project, unlike some methodology. PR does not recognise or see participants as an object (Sarason, 2003). In other words, PR stresses the importance of participants been involved in the process of the project by sharing their experiences. It also emphasises the importance of participants working together by finding solutions to their own problems as supported by (Baum, MacDougall & Smith 2004). Meanwhile, the study made use of concerned people to be part and parcel of the

research project by providing solutions. In this case, the students, the SI leaders, the lecturers who are directly or indirectly connected to the SI in the university were involved in this study.

Data generation method and process

The study adopted an unstructured interview for the data collection. Unstructured or in-depth interview is derived from the discipline known as anthropology and sociology as a method used to extract people's social reality (Zhang & Wildemuth, 2016). Unstructured interview is the type of interview method that allows the researcher to dish out open-ended questions to the participants for them to express their perceptions in detail about the topic at stake (Firmim, 2012). The researcher had meetings with the participants to schedule the time and date of when they will be available. Data were collected through an interactive interview where every conversation was recorded on each meeting lasted for 30-45 minutes. Unstructured interview is deemed fit for this study as it allows participants to express how they feel by sharing their own experience on a certain topic. This, in other words, means that the participants were allowed to be part of the knowledge construction which aligns with constructivism assumption of how knowledge should be constructed (GetRevising, 2016).

Participant and Selection of Participant

Eight participants were selected in accordance with their relevant roles and appropriateness to the study: two lecturers, two tutors, two SI leaders and two first-year students. The lecturers were selected based on their teaching experiences regarding the particular module under investigation. Two tutors were selected because they were among tutors that facilitate the module, the two SI coordinators were selected because they are responsible for the administrative work such as recruiting, payment, the academic performance of students to mention but a few. The two first-year students (tutee) were also selected because they are the ones at the receiving end; that is, students who are being tutored by the senior students. Because the study is to enhance the academic performance of first-year students and in order to achieve that, there is a need to involve the relevant stakeholders as to know the challenges they were faced with under the principle of PR and social constructivism.

Data analysis Method

The study adopted Thematic Analysis (TA) to analyse the data generated. Thematic Analysis is defined as the method of categorising data into themes in qualitative research (Maguire & Delahunt, 2017). TA is of the opinion that themes should be organised in such a way that it addresses the research to enable the researcher to share experiences (Vaismoradi & Snelgrove 2019). TA was used to analyse the data collected in this qualitative study. According to Braun & Clarke (2012), six methods of data were used for the analysis; the researcher familiarised herself with the data, generated codes; searched for the themes, reviewed the potential themes, named each theme; and produced the report; each group of the categorised data was interpreted and given meaning. The above thematic process was followed thus; participants were interviewed and data transcribed, followed by categorising of data according to their meaning repeatedly. Since the data collected was guided by the research question of the study, the themes were arranged appropriately under the two research objectives (the challenges facing SI implementation and the proffer solutions).

Ethical Consideration

The study was approved by the ethical committee of the University of the Free State. The consent of the participants was sorted for, and they were provided with information that,

during, and after the study, their information and utterances will be kept confidential from the third parties. They were assured that their names would not be disclosed to the third party and that their responses would remain anonymous.

PRESENTATION OF DATA AND DISCUSSION

Since the study is aimed at enhancing the academic performance of first-year students in universities using supplemental instruction, below are the challenges that hinder the implementation of SI and the suggested solutions; Overcrowded and Institutional challenges were found to be one the challenges while proper planning and provision of educational facilities were suggested as solutions. Institutional challenges such as overcrowded are some of the challenges facing the implementation of supplemental instruction in universities. At the same time, proper planning and provision of adequate educational facilities were found suggested as solutions.

The challenges associated with the use of SI to enhance academic Performance of first-year students

Overcrowded classrooms

Overcrowded classrooms are one of the challenges facing South African universities currently. A lot of factors can lead to a class being overcrowded, including lack of funds to execute certain programmes such as venues for tutorials in a university. Overcrowded classroom was found as one of the challenges that hinder the implementation of SI in any institution of higher learning, such as universities (West & Meier, 2020; Muthusamy, 2015). When a classroom is crowded, it becomes a problem to students, lecturers and especially for tutors to conduct their tutorial sessions in a meaningful and effective manner. Omodan & Tstotesi (2018) confirmed that Overcrowded classroom leads to ineffectiveness of lecturers as it also disturbs the students-lecturer relationship, which disrupts the academic performance of students. Here are what participants said concerning this:

Participant C2; *“Overcrowded classes are a huge challenge to the success of SI because when you go to class and talk alone the entire time because students just want to register their names and exit.”*

Participant C1; *“In some of the tutorials, they just come to register their names and leave without listening to the tutor. So, in terms of overcrowded classes, you will be standing there trying to conduct a tutorial and students at the back will be talking and some making gestures, comments it renders the whole session useless.”*

In this section, participants' comments are analysed in relation to overcrowded classrooms as a challenge to the implementation of SI. For any teaching and learning to be effective, there must be a conducive environment to enhance teaching and learning; and such also applies to tutorial sessions. One of the participants said that overcrowded classes are challenges to the success of implementing SI in the sense that when tutors get to class, it is difficult for them to make decorum, which leads to tutees (students) coming to the class just to mark register and leave. The only reason behind this kind of behaviour could either be the noise from the students due to lack of space to sit on while some are standing on their feet. These are, but few difficulties faced by tutors in managing tutorial classes. Therefore, the implementation of SI will be very difficult in this situation, which may lead to frustration and hinder effective teaching and learning and also make the implementation of SI unsuccessful. This is supported by what another participant also said that because of the large class size, students who managed to come to class only come because of attendance register and thereafter, they leave.

These arguments indicate that overcrowded classrooms are a big challenge to academic success anywhere in the world if not tackled (Olaleye, Ajayi & Ajayi, 2017).

It was deduced that, as much as this study seeks to enhance the academic performance of first-year students using SI as learning support, student-teacher ratio needs to be considered as stated by Muthusamy (2015). This means that the number of tutees per tutor should be between 15 and 25. With the small number, tutors will be able to facilitate effectively, and attend to every tutee. The researcher agrees with the statements from the participants C1 saying that overcrowding is a challenge not only to the successful implementation of SI, but also to the progress of effective learning of students and the reputation of the university at large. Consequently, in order for students' academic performance to be enhanced in a university using SI, there must be the implementation of SI without any disruption.

Institutional challenges

Insufficient lecture halls, water, electricity to mention, but a few, are seen to be institutional challenges. One of the biggest challenges we have in South African universities and especially the university where the research was conducted is the issues of educational facilities. There is no way a university can perform well without facilities, especially lecture rooms where students can sit comfortably during a lecture. This challenge concurs with the responses from co-participants below:

***Participant D2:** Lack of venues and infrastructure-number of students increase every year, such that most of the tutorials are overcrowded.*

***Participant A1:** The rate at which the campus grows makes it impossible to predict the number of students per tutor....*

***Participant A2:** Tutorials clash with the students timetable-students who are enrolling for the tutorials are those who have failed the module, so their timetable clashes with their tutorials...*

From the above statements, it is clear that the university does face the challenges of lecture rooms, which makes SI implementation a problem. Participant A1 said that every year the number of students do increase such that tutorials are overcrowded. This is to say that in the selected university, lecture rooms are problematic and without this, to implement supplemental instruction will be difficult. For instance, in a large class of 600 students where tutors have to divide themselves into smaller groups, it becomes a challenge. The student-teacher ratio of 21:1 would have worked perfectly where a tutor is facilitating 21 tutees (OECD 2009, 70-71).

Even though the data generation tool used for this study was an interview, I could feel that the participants were not happy with the situation and wished there could be solutions as soon as possible.

***Participant D2** "Lack of venues and infrastructure-number of students increases every year such that most of the tutorials are overcrowded."*

To support the discussion above, venues are a big challenge facing the success of SI. Also, apart from the venue problem, facilities such as insufficient chairs and some projectors not working perfectly (Omodan, Kolawole & Fakunle, 2017). Therefore, for tutors to function effectively in a university, institutional challenges such as venues should be given priority. From participant D2 perspective, the rate at which the students' population increases is another challenge that the university has to take into consideration in terms of planning. This is also supported by my observations in the selected university where there are up to 800-

1000 students in a class with lesser capacity. In this situation, it is very difficult for tutors to conduct successful tutorial sessions, and thereby, hinders student's academic performance.

The Suggested solutions to the challenges associated with academic performance

Proper planning as a proffered solution

Adequate planning was suggested as a key solution for the successful implementation of SI in universities during the data generation process. Planning, according to Ajayi, Ayodele and Ekundayo (2005) is the foundation of any successful programme, including SI. Failure to plan this could lead to the unsuccessful implementation of activities such as tutorials (Moleko, Hlalele & Mahlomaholo, 2014). In every academic activity, planning is a crucial factor that cannot be neglected, more especially in a university. For any program like SI to be successful, there must be proper planning from all the people concerned. Planning is emphasised as one of the solutions that could make the implementation of SI possible because if there is adequate planning, both students and tutors will know what is expected of them. Here are the comments from participants:

Participant D1: *“Tutorials clash with the students’ timetable. Students who are enrolling for the tutorials are those who have failed the module, so their timetable clashes with their tutorials...”*

Participant B; *“Then with the recent ones the other condition could be just to make sure that we check the class attendance against the dates on which the tutors will be attending teaching practice because that on its own could be a challenge. If a lecturer plans his work and tutors are not on campus because of teaching practice; therefore, we need to check the teaching practice dates”.*

Participant D1; *“Timetable clash at some point clashes with that of the tutors, which renders our tutorials at some point to be not important because they are voluntary by nature. Some students don’t attend tutorials or neglect tutorials, but we can’t blame them because of timetable clashes.”*

From participant B, it is obvious that there is a need for planning, especially concerning the issue of teaching practice. Senior students who are also tutors do go for teaching practice for the period of 5-8 weeks as a requirement to complete their study. To address this, all the concerned stakeholders such as SI personnel, tutors, lecturers and even the management of the university needs to come together and make a better plan. The issue of timetable clashes is becoming a critical problem in the university, and its urgent solution. This problem is mentioned by almost all the participants in study. The fact that it is the most mentioned issue hindering students, lecturers and even SI personnel's academic programmes demands attention. I think the issue of timetable clashes is beyond students, lecturer and SI personnel, but rather the management of the university. Participant D1 said that this issue has led to some students neglecting tutorial sessions, and this is because of lack of proper planning. Meanwhile, participant A2 said that some of the students attending tutorials are those students who failed because of clashes with other modules at the same time, which could have been avoided if there was a proper timetable planning. From all the data above, it is evident that adequate planning is a condition conducive that can enhance the implementation of SI if given attention.

Participant A2; *“conditions for the lack of venues, the university can have a zinc or prefix like temporary accommodation to solve the shortage of venues.”*

According to participant A2's second point, she suggested that the university could erect temporary buildings where students could have their tutorial classes pending the time they

will build proper venues if there is adequate planning on the ground. Lack of lecture rooms was revealed to be one of the major challenges both students and lecturers do encounter during classes because of inadequate planning. For SI implementation to be successful, it means there should be venues where tutorial sessions can take place, and students are able to learn effectively, but this requires that planning should be given a priority. For any organisation to achieve its goals, there must be adequate planning from every stakeholder; otherwise, failures will be inevitable. There is a say that “he who fails to plan, plan to fail”, this means that planning should be the foundation of any programme. Likewise, if SI stakeholders neglect the place of proper planning, the academic performance of students could be disrupted (Boyd, 2016).

Participant A1: *“Tutors Recording themselves and send to the students via the blackboard so that they can view on their own time, this can be a response to the problem of clashes and venues.”*

Another suggested solution that could make SI implementation possible according to participant A is the recording of one’s work (Podcast). This means that tutors can record themselves through their phones and post it to the blackboard for tutees to download and listen to at their own time. This will solve the problem of venues because this can be listened to anywhere one is at. It will solve the problem of clashes because you do not have to be in class to listen to it and lastly, it is convenient for both tutors and tutees. Apart from tutors, even lecturers can also adopt this approach to their students, since the academic world is becoming more technological in approach (Moleko, Hlalele & Mhlomaholo, 2014).

Provision of Educational facilities

For any organisation like a university to succeed, there must be adequate provision of educational facilities such as; conducive lecture rooms, projectors, library, among others. This is buttressed by Kausar, Kiyani and Suleman (2017) that educational resources are required for the sustainability in teaching and learning activities. The implementation of SI will, therefore, be hindered if all the above-mentioned facilities are missing in any higher institution of learning including South African universities. Therefore, there is no doubt that using SI to enhances academic performance of first-year students in universities according (Buckley, Schneider & Shang, 2004). They suggested that adequately equipped environment enhances conducive students/tutor interactions. Below are what the participants suggested to be conditions that will make the implementation of SI successful:

Participant B2 *“Solution for the lecture halls with no air conditioners-if air conditioners can be installed so that students can come to class.”*

Participant B1; *“The other condition is the issue of venues we need more as well as smaller venues that can accommodate students.”*

Participant C2: *“sometimes tutor is prepared for the tutorial only to discover that there is no electricity. Even the internet sometimes affects the smooth running of tutorials.”*

There are some issues such as venues without heater during winter and interruption of electricity that are overlooked by university management as nothing serious. However, these could hinder the progress of students. From the statements made by Participant B2, it happens that some students do stay away from tutorial sessions, especially at the peak of winter (June/July). The suggestion here is that if the environment is conducive for learning, students will want to come to class. That is, the installation of heaters in lecture venues could be one of the solutions to the challenges facing the implementation of SI (Buckley, Schneider

& Shang 2004; McGowan, 2007). Meanwhile, for any university to succeed there is a need for adequate educational facilities, including lecture rooms/venues. Besides adequate educational facilities, another challenge encountered is of timetable clashes. The summary of participant B1, B2 and C2 are that no stone should be left unturned if the goal of any organisation and especially university wants to be achieved, and therefore, conducive educational facilities are a necessity.

Conclusion

Based on the above analysis, the study found out that hindrances such as overcrowded classroom and instructional challenges were indeed an obstruction to the implementation of supplemental instruction in the selected university. Therefore, the study recommends that; to enhance the academic performance of first-year students in universities using supplemental instruction, there is a need for the provision of educational facilities such as conducive lecture rooms, projectors, library, uninterrupted electricity supply, water, among others. Besides, there is no organisation that can succeed without adequate planning, especially when it comes to universities whose goals are to see that students' academic performance is the utmost achievement. Therefore, there is a need for proper planning within the SI department to enhance the successful implementation of SI in universities. In conclusion, the study, therefore, suggests that if the recommendations could be implemented adequately, the academic performance of first-year students will be enhanced in universities.

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VIEWS STUDENTS CONSIDER ESSENTIAL IN THE TEACHING AND LEARNING OF N-LEVEL 4 ECONOMICS

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Abstract

Students' have different views, which could affect their teachers' relevance in an excellent and wrong way to teach and learn economics in the Technical and Vocational Education and Training (TVET) context. However, teachers who possess the Further Education and Training qualification teaching in the Technical and Vocational Education and Training band are unaware of these views. This paper reports on the study that established the views that students considered necessary in the teaching and learning of N4 economics. A quantitative research method was used to select a survey research design. Data were collected through questionnaire completed by 62 students who voluntarily participated in this study. The Economics teacher taught the students in their first semester before the questionnaire was administered. The teacher had a Bachelor of Education: Further Education and Training (FET) phase economics and postgraduate certificate: Further education and training teaching in a Technical and Vocational Education and Training College. The study revealed eleven views that students viewed important in the teaching and learning of N4 economics. This paper highlights the eleven views teachers should consider in the teaching and learning of N4 economics.

Keywords: *Qualifications, students' views, teaching and learning, technical and vocational education, and training,*

Introduction

The economics teachers who have been trained to a teacher in further education and training band are dealing with late adolescents learners in their development toward adulthood. At this stage, learners are exposed to positive or negative kinds of emotional, physical, and cognitive developments that affect the way they are taught and learn economics. Attending to these developmental phases in a healthy, expected manner during the teaching and learning will help learners to achieve their full potential. For this study, learners are from grades R-12 in schools, whereas the students are in Higher Education institution e.g. people studying at TVET colleges.

On the other hand, the lack of relevant teacher qualification for Technical and Vocational Education and Training (TVET) teachers led to the hiring teachers with Further education and Training (FET) qualifications to teach in TVET colleges and bring along the risks of pedagogical abilities. These TVET teachers' offer National Accredited Technical Education Diploma (NATED) programmes in business studies and economics a subject offered from N – level 4 - 6 also referred to as N4 – N6 are under the auspices of the Department of Higher Education and Training (DHET) band. Currently, the problem of economics and low-performance results seems to be a global problem, and according to literature reviewed (Leet & Lopus 2012; Allgood, Walstad & Siegfried 2015), they state that there has been a great deal of scholarly interest in improving teaching effectiveness in the economics discipline. Besides, limited training brings into effect many challenges in the teaching and learning of economics, such as lack of knowledge of alternative teaching methods and the use of wrong teaching methods (Kimotho, 2016).

The debate about the views of learning would be infinite, and the issues they all concern are beyond the scope and interest of this paper. Although the participants that take part directly in this paper are still out of the fence, hence, this study explored the views that students consider essential in the teaching and learning of N4 Economics.

Theoretical underpinnings

The theoretical underpinning for this study reports on the three views in which learning can take place by Johnson (2010), namely, transmission, transaction, and transformation. The academic achievement seen as students' ability to demonstrate, replicate, or retransmit this designated body of knowledge back to the teacher or some other measuring agency or entity is known as a transmission view of learning (Johnson, 2010). At the same time, the transaction view is situated in constructivism, perceived that the teacher provides conditions for students with the teaching of content and allow them to construct knowledge actively (Vinnakota, 2016). Lastly, the transformation orientation expands the transformation orientation to increase student control over their learning and to enhance their self-motivation and self-direction with the teacher acting as a co-learner (Sharan, 2010).

Literature review

Little research has been conducted on the TVET sector worldwide and especially in South Africa, on the development of TVET teacher qualification. The research found on TVET teachers' qualifications focused on the training of economics teachers to teach in Further Education and Training (FET) schools (Koopman, 2013). In developing the TVET sector, teacher qualification the Department of Higher Education and Training, DHET, (2015) in collaboration with the European Union, the capacity building of TVET College lecturers through open learning sub-programme. After their collaboration, a four-year programme in 2017 was initiated for the South African universities to develop programmes relevant for TVET lecturers (DHET, 2018). However, the process of university accreditation for TVET lecturers has not been finalised (Van der Bijl & Nduna, 2018).

The implications, however, of the TVET sector has articulated a gap among the TVET academic qualification of teachers in TVET colleges (DHET, 2015), which are exceptionally problematic. Not only are the students failing economics of a particular Nated level, but the TVET sector has at least two repercussions. First, the TVET sector merely allows for the teachers to enter without the relevant TVET teaching qualifications, thereby shifting the teachers' competency to students' performance. In some instances, the recruitment practices of TVET colleges appoint educators from the ranks of their graduates since there is no other trained personnel available (Beukes, 2018). Second, students are aware of the articulated gap in the TVET sector, not because they have read the TVET sector policies, but because they notice the hiring of teachers, and so they do the barely minimum, or nothing at all and rely on the teachers to avoid high failure rate.

Students' views constitute an essential reference to be taken into account while determining the efficacies of a teacher (Akbas, Cancan & Kuliç, 2019). While it is essential to know the views about economics teachers teaching and learning, it is vitally important to obtain the views of the students who had a length of time with the teacher. Assessment of teachers through student opinions has been the most used method to define the characteristics of teaching quality (Pozo-Munõz, Reboloso-Pacheco & Ndez-Rami' rez, 2000). Since students and teachers are crucial role players in the teaching and learning, in this study, students' views were taken into account when exploring the TVET teachers teaching relevant to the TVET qualifications. Furthermore, the importance of economics teaching and learning is

essential in the period of TVET college transition in which students develop their economics knowledge, and evaluate the teaching of their TVET economics teachers with FET qualifications.

To our knowledge, there is limited research on the learners' views about teaching and learning in TVET College course qualification. Currently, TVET teachers obtained FET qualifications, which include Shulman (1987) seven categories of knowledge as the basis for teachers teaching, namely, content knowledge, curriculum knowledge, and knowledge of learners, knowledge educational context, pedagogical content knowledge (PCK), knowledge of educational ends, and general pedagogical knowledge. First, content knowledge gained from schooling in university and college courses or from personal research interest (Gregson et al., 2015). Also, Bourdillon and Storey (2002), a lack of CK, can cause teachers to avoid teaching unfamiliar topics. Second, the curriculum inquiry takes many forms, disciplinary and interdisciplinary, and through it, curriculum knowledge is derived (Kridel, 2010). Third, the knowledge of learners includes general knowledge of what pupils of a certain age are like and specific, context-bound, knowledge of a group of learners, i.e., "my class" (Brant, 2006:10). Fourth, knowledge of educational contexts ranges from "the workings of the group or classroom, the governance, and financing of school districts, to the character of communities and cultures" (Shulman, 1987: 8). Since the TVET college teacher does not have a relevant qualification yet, fifth, PCK can be developed through experience. Although the nature of that experience matters, some types of experiences seem to be more helpful than others in enhancing teacher's PCK (Cooper, Loughran, & Berry, 2015). Sixth, knowledge of educational ends, and purposes, and values, and their philosophical and historical grounds refers to knowledge of the value placed on economics topics within the school and economics curriculum. Seventh, General pedagogical knowledge is the general knowledge about teaching gained from practice (Brant, 2006). These categories of teacher knowledge may influence the way the teacher teaches economics to N4 students.

Methods

This quantitative research approach used a survey research approach to explore the students' views about the teaching of economics. A voluntary sampling strategy was used to select a sample of 62 Economics N4 students to participate in the questionnaires. Murairwa (2015:185) described a voluntary sample as a selection of the final sample from potential respondents who are willing and who qualify to participate in the survey. A questionnaire developed by the authors was named the Economics Classroom Views Questionnaire (ECEQ) based on Shulman (1987) seven categories of knowledge. The 4-point Likert scale was used ranging from strongly disagree = 1 from 1,00 – 1,49; disagree = 2 from 1,50 – 2,49; agree = 3 from 2,50 - 3,49; and 4= strongly agree from 3,50 – 4,00. The questionnaire had two sections, section A: biographical information and section 2: views of N4 economics students with eleven items. To complete the questionnaire, the participants were economics students who would give their views on economics teaching. The 30 economics students who were not part of this study completed the ECEQ, and authors sent the ECEQ to two TVET economics teachers for content validity, and their responses and the aspects identified from the students' responses were included in the final draft of ECEQ. Ethical clearance obtained from the University of the Free State Faculty of Education (UFS-HSD2018/1627/0905) and the principal of Motheo TVET College.

Results / Discussions

Data from 62 participants who completed the ECEQ items were analysed, with the help of excel software using descriptive statistic methods, such as figures. The percentage response

for each phrase on what views participants consider as crucial in the learning of economics and presented in figures 1-11. The two bars on the left of each figure imply that the participants view the phrases listed on the left more than those listed on the right-hand side. On the other hand, two bars on the right of each figure imply that the participants view the phrases listed on the right more than those listed on the left-hand side. See the first figure below.

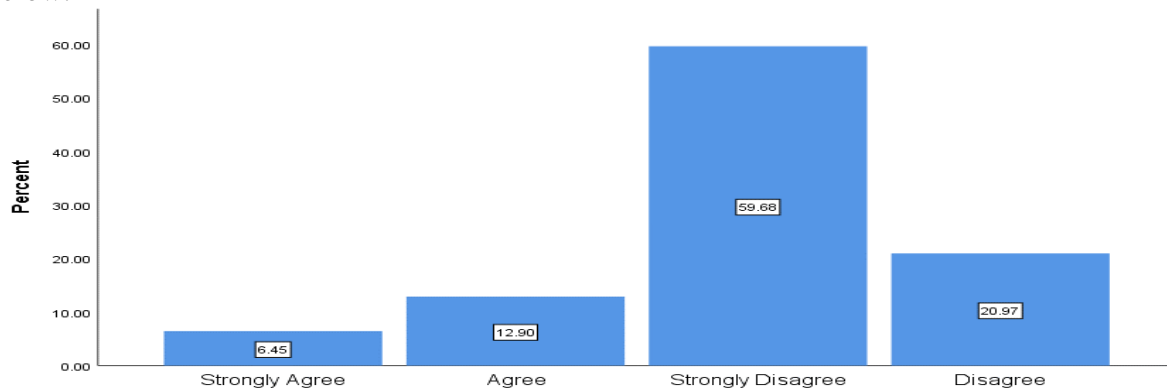


Figure 1. Knowledge of syllabus content and goals

The majority of the participants (80.65%) did not view their economics teacher to possess the knowledge of the N4 economics curriculum. In contrast, less than a quarter of the participants (19.35%) view their economics teacher as possessing the expected knowledge of the curriculum to teach economics to N4 classes. Mabotja, (2019) agrees with the finding of this study that TVET colleges were recently under the spotlight for employing under-qualified lecturers and using outdated curricula. These views suggest that the knowledge of the syllabus taught to N4 economics students might help the teacher to sequence the topics that help to understand the qualifications of teachers. The teacher's ability to sequence the syllabus and the ability to understand the syllabus can be achieved if the participants view the economics teacher's syllabus as relevant and essential to learning economics.

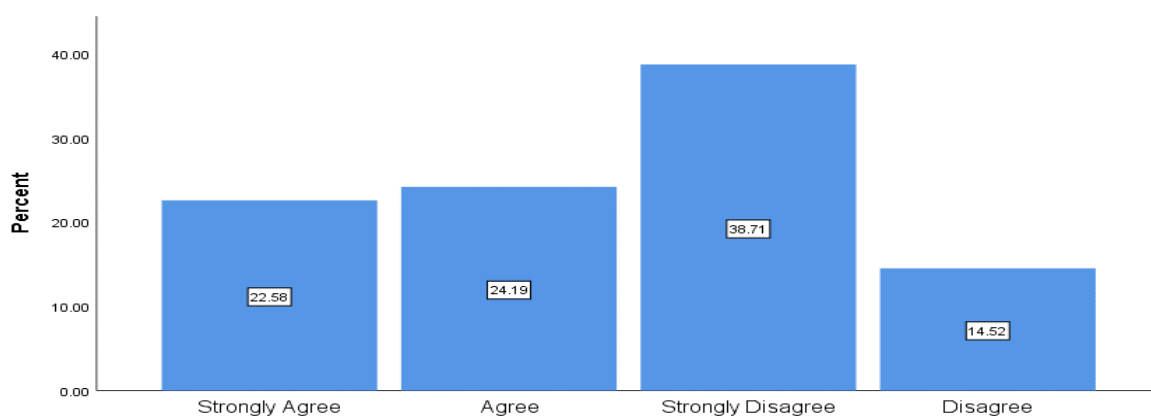


Figure 2. Knowledge of subject matter

Slightly more than half of the participants (53.23%) viewed that their teacher does not possess adequate knowledge of economics for the N4 class. In contrast, less than half of the participants (46.77%) viewed that the economics teacher had insufficient knowledge of economics concepts. In the TVET sector, it is not a matter of updating the knowledge of subject matter and pedagogical knowledge of teachers, but they need attention (Paterson, 2016). Knowing the depth and breadth of the subject matter taught might help the teacher to explain the concept in a variety of ways. The teacher's use of different representations to

teach the economics concept, and the participants' ability to interpret and make sense of the representations can be achieved if one viewed the subject matter useful in learning N4 economics.

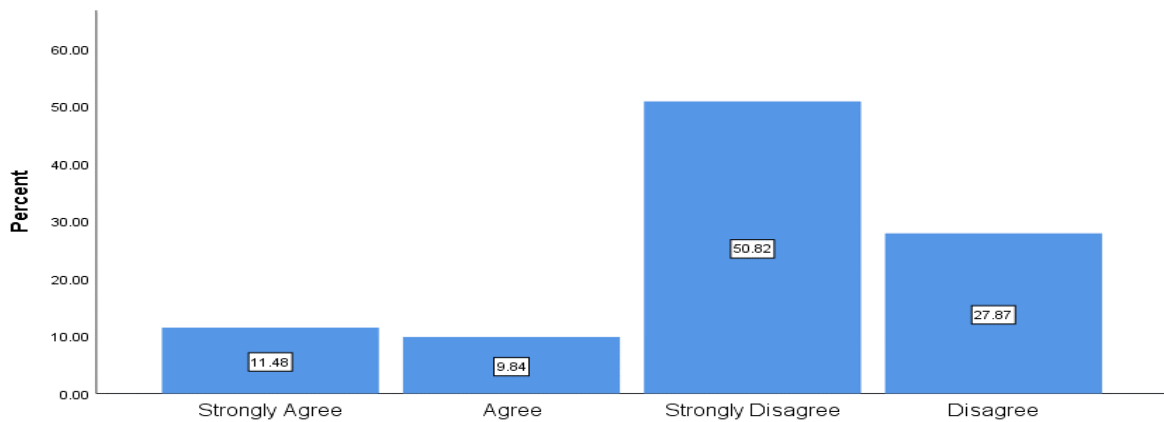


Figure 3. Knowledge of economics laws and concepts

Slightly more than three-quarters of the participants (78.69%) view that their economics teacher does not possess the content knowledge for N4 economics. In comparison, less than a quarter of the participants (21.32%) view the economics teacher as having sufficient content knowledge of N4 economics. The lack of knowledge may be real since students usually have minimal working experience, and most time spent on the courses is to provide students with basic knowledge of economics and business administration (Bjorkegren, 2018). Nonetheless, the participants seem to be consistent with figures 1 and 2 about the economics teacher's lack of economics knowledge. Knowing the content knowledge of economics might help the teacher to select the relevant laws and procedures, and also, the ability of the participants to relate to the laws and concepts of economics can be achieved if one views the laws and concepts useful in the learning of economics.

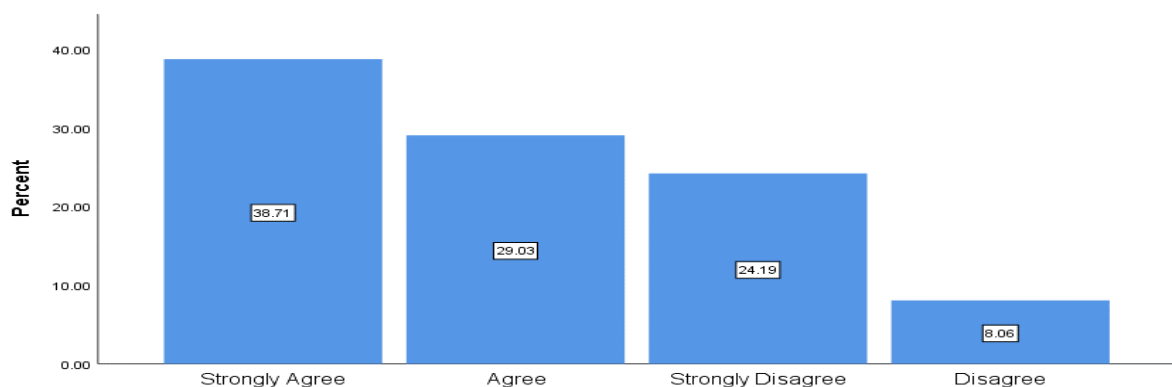


Figure 4. Different teaching methods

The two-third of the participants (67.74%) view their economics teacher is using a variety of methods to teach economics. In comparison, slightly less than one-third of the participants (32.25%) view their teacher as not using different teaching methods to teach economics to the N4 class. Bukit (2012) states that the issues and challenges of TVET teachers are quite different from general teachers and thus require a distinct response in terms of skills and competencies that should be updated regularly alongside technological developments and linkages with industries. The finding suggests that the students view teaching methods differ from the teachers; hence there are inconsistencies.

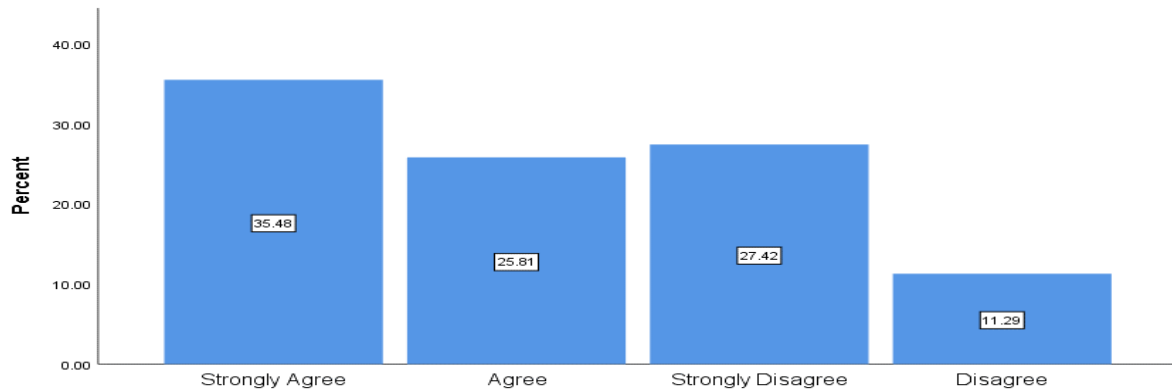


Figure 5. Different and relevant materials used

Slightly less than two-thirds of the participants (61.29%) view their economics teacher as using a variety of resources to teach economics. The finding of this study contrasts with Bünning and Schmidt (2018) state that there is a proven shortage of resources, such as teaching materials and teaching aids (overhead projectors, pin boards, etc.), training laboratories and equipment as well as computers and safety equipment in TVET institutions. On the other hand, slightly above one-third of participants (38.71%) view their economics teacher as not using a variety of resources when teaching economics. The contradiction seems to occur, though economics teachers lack the content knowledge to teach economics.

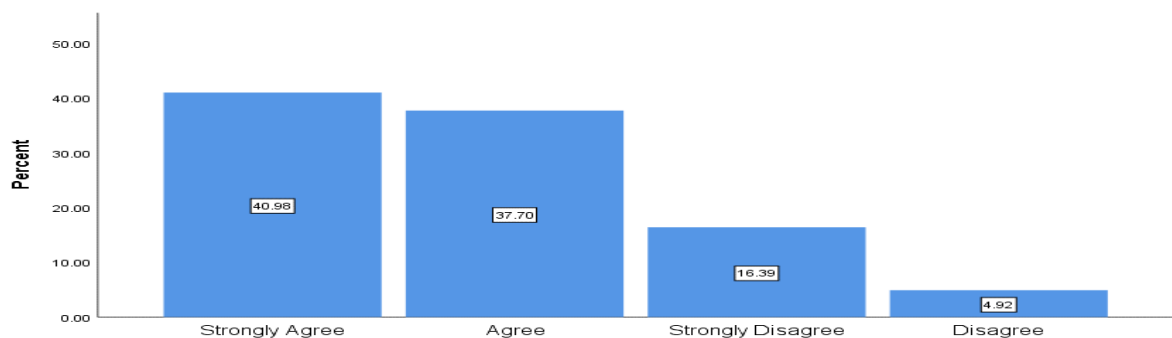


Figure 6. Teaching styles matched to the learning style

Slightly more than three-quarters of the participants (78.66%) view their teacher as able to match their learning styles when teaching economics. In comparison, less than a quarter of the participants (21.34%) view their teacher as not teaching to meet their learning styles. Although the usefulness of other teaching strategies examined, the traditional lecture remains a vital way to communicate information mainly in theory-laden subjects (Yusof, Roddin & Awang, 2014). There is an inconsistency between the literature and the findings of this study about the teachers teaching styles that matches the students learning styles. The finding suggests that some factors may contribute to this inconsistency, and further investigation is needed.

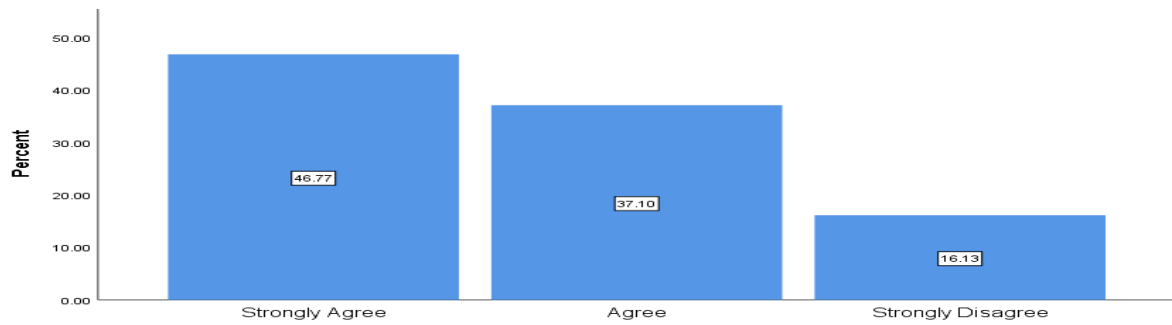


Figure 7. The teacher knows how I learn

More than three-quarters of the participants (83.87%) view their economics teacher as knowing how they learn N4 economics. In comparison, less than a quarter of the participants (16.13%) view their economics teacher as not knowing how they learn. The participants seem to agree that their teacher can match their learning styles and also know how they learn economics. The study by Blom (2016) disagrees with the finding of this study and states that TVET teachers also find that the students become demotivated due to their failure to progress and then lose interest in learning. The finding suggests that TVET teachers may not know how students learn; hence they fail. Bukit (2012) further states that it was essential to gain insight into the type of learning environment to select the appropriate teaching methods and appropriate learning materials to enable TVET students to learn most effectively.

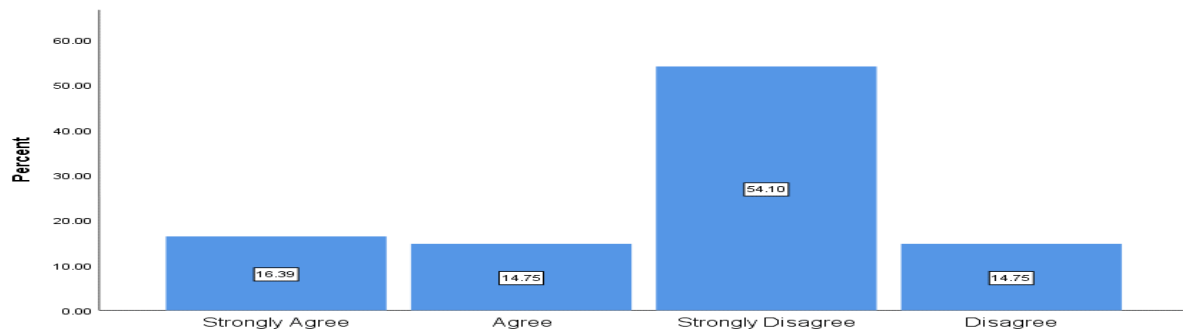


Figure 8. Teaching methods relevant for TVET

Slightly more than three-thirds of the participants (68.85%) view that their teacher does not use teaching methods relevant for TVET, though they agreed earlier that their teacher uses different teaching methods. Research seems to agree with this results that there is limited research on TVET teaching methods (Bukit, 2012) states that it is essential to gain insight into the type of learning environment, teaching methods, and appropriate learning materials to enable TVET students to learn most effectively, and also consider the development of their personality. In comparison, less than a third of the participants (31.15%) view the economics teacher as using the appropriate teaching methods for the TVET context.

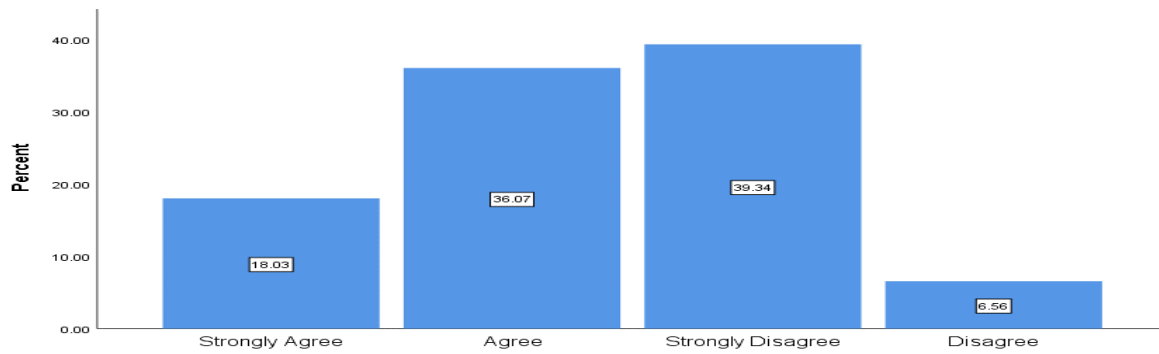


Figure 9. Inappropriate teaching matches the purposes and values of TVET

Slightly more than half of the participants (54.1%) view that the TVET economics teacher teaches according to the purpose and values of TVET. In comparison, slightly less than half of the participants (45.9%) view that the economics teacher does not teach according to the purpose and values of TVET. The DHET (2013: 11) states that the primary purpose of TVET colleges is 'to train young school leavers, providing them with the skills, knowledge, and attitudes necessary for employment in the labour market. The finding suggests that the majority of participants seem to agree that the teacher prepares them for the world of work in her teaching.

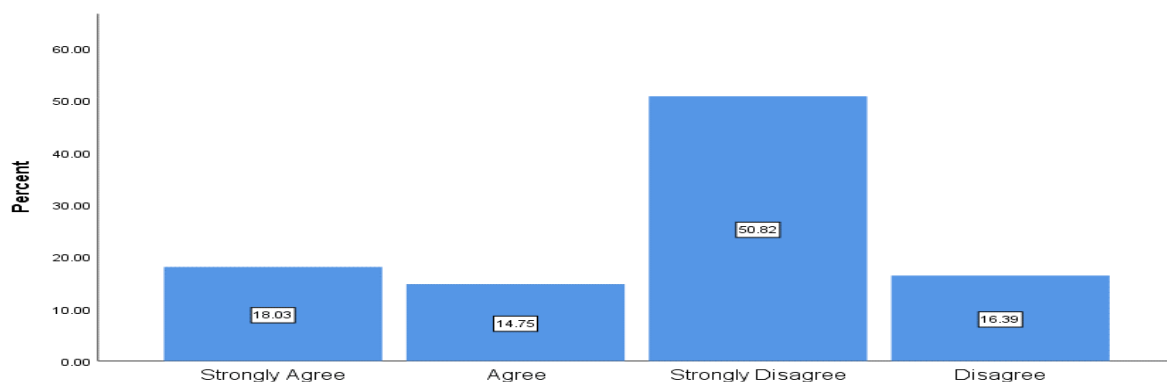


Figure 10. Lack of relevant classroom management skills

Slightly more than two-thirds of the participants (67.21%) view that the TVET economics teachers as not having the relevant classroom management skills. In comparison, less than one-third of the participants (32.79%) view the economics teacher to have relevant classroom management skills. Oosthuizen (2018) agrees with the findings of this study that TVET lecturers without a formal teaching qualification lack the required skills for managing classroom activities effectively, and until they have learned these skills through experience, they contribute to misconduct. Also, Ismail, Mohd, and Mohd, (2018) from their study found that on their interviews with lecturers, teachers, and industrial workers, the issues of incompetent teachers reside in their teaching methods, weak classroom management, lack of industrial experiences, lack of competency skills, and disinterest in teaching the assigned subjects. The majority of the TVET economics students viewed their teachers not knowledgeable about the relevant classroom management skills.

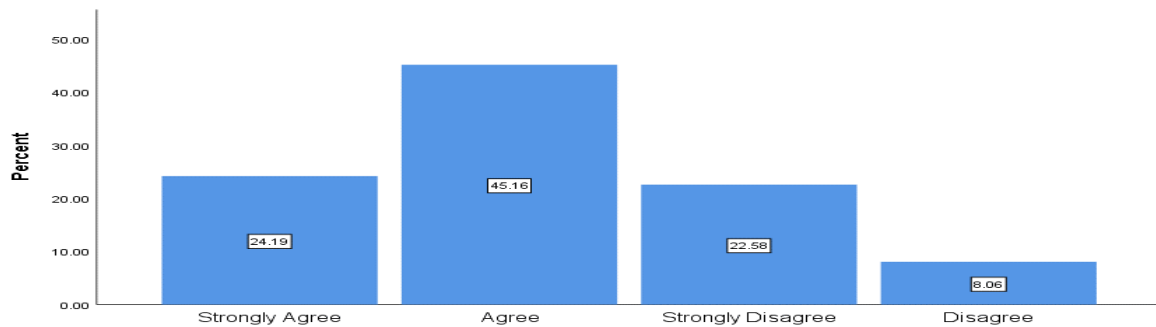


Figure 11. Complete the syllabus on time

Slightly more than two-thirds of the participants (69.35%) view the economics teacher as able to complete the economics syllabus on time. In comparison, less than one-third of the participants (30.64%) view the economics teacher not being able to complete the economics syllabus on time. A study by Buthelezi (2018) investigated the lecturer's experiences of TVET College challenges in the post-apartheid era, a case of unintended consequences of educational reform in South Africa, and one of the findings from his study reveal that lecturers are pressed for time to finish the syllabus. The finding seems to suggest that the completion of the syllabus on time is the priority for TVET teachers.

Findings

This study reported on a study that explored the views students consider essential in the teaching and learning of N4 Economics, and we gathered data from 62 participants who completed the questionnaires. The study revealed eleven students' views considered essential in the teaching and learning of economics in TVET College. The eleven views include the lack of knowledge of syllabus content and goals, lack of subject matter knowledge, lack of knowledge of economic laws and concepts, appropriate teaching methods, a variety of relevant materials to teach economics, the ability to match the students' learning styles, knowledge of how students learn, lack of teaching methods relevant for TVET, appropriate teaching matches the purpose and values of TVET, the lack of relevant classroom management skills, and the ability to complete the syllabus on time. These findings suggest that views students consider essential focus on the transmission view of teaching and learning.

The limitation of this study reported in this paper is that the authors used a questionnaire with 11 items to explore the views of students on what they consider essential in the teaching of N4 economics. Nonetheless, the extent to which these views relate to the teacher qualification is not determined. The study locates itself in one Motheo TVET college, Free State, South Africa, and also prevents the generalisation of results to other contexts. Further studies could also include the views of N4 economics students about their economics teacher.

Conclusions

The authors conclude by addressing a specific issue, and we did not conduct the investigation expecting to see all the views of the economics students. While the results encourage us, and we are vigilant not to be confident. This study provides evidence that TVET economics students can participate in a survey to learn from their teacher's teaching of N4 economics that may help to understand the teacher qualifications through their actions. Nonetheless, further research is needed. We understand that the results from this data set cannot be generalized to other TVET College students. Our analysis further points out ways in which TVET teachers interact with students in the teaching and learning of economics, but this

could not be the only way. This study raised important questions as to whether the design of the survey research analysis helped the economics students to view the teaching and learning of N4 economics in this setting.

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PROSPECTIVE MATHEMATICS TEACHERS' PERCEPTIONS OF ONLINE LEARNING IN MATHEMATICS EDUCATION MODULES: INSIGHT FROM COVID-19 PANDEMIC ERA

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Abstract

Technological advancement is gradually affecting every aspect of our daily lives, from the simplest interaction of our daily activities to the most essentials of educating students online. The outbreak of the Covid-19 pandemic that led to the shutting down of schools triggered the use of online learning in many countries including South Africa to reduce the negative effect of COVID-19 on the education system. Consequentially, countries started to implement online learning as a solution to shutting down schools or at least to mitigate COVID-19 serious consequences on the global education system. Hence Online learning is an immediate and unplanned shift in teaching and learning to save the education system from total collapse. This research explored the extent to which the Covid-19 pandemic era determined prospective mathematics teachers' perceptions of the need for using online learning in their mathematics education modules. This study involved a sequential mixed-method using convenient purposive sampling to select 42 prospective mathematics teachers enrolled for a mathematics methodology module in a selected higher education institution. Self-administered questionnaires and semi-structured interviews were instruments used for data collection. Descriptive analysis was used to analyzed participants' responses to questionnaire items. Qualitative data analysis of a semi-structured interview extract was done thematically. The main finding of this research has shown that prospective mathematics teachers' improved performance in mathematics education modules should be attributed to online learning. Besides, this research also revealed that prospective mathematics teachers through online learning demonstrated a deeper understanding of content and displayed higher-order thinking skills required for their future teaching career. However, pre-service teachers still need training and support to engage meaningfully in online learning strategies.

Keywords: Covid-19 pandemic, global education system, integrated online learning module, mathematics education module, online learning

Introduction

The outbreak of the Coronavirus pandemic (COVID 19) has become the defining global health crisis that led to shutting down schools in many countries including African countries (Upoalkpajor & Upoalkpajor, 2020). Consequently, the education process was stagnant or in most countries forced to a complete halt. However, it is important to recall that the Education system was already experiencing a global learning crisis before the COVID-19 pandemic era (Saavedra, 2020). This is because school learners and students were not learning the fundamental skills needed for lifelong professions. The outbreak of COVID-19 has certainly worsened the situation as humanity is facing the greatest threats in our lifetime to the global education crisis. Before the outbreak of the COVID-19 pandemic, the World Bank's "Learning Poverty" indicator revealed that the percentage of learners in developing countries who could not read and write at the age of 10 stood at 53% (United Nations, 2020). The Covid-19 impact on education envisaged by the United Nations (2020) revealed that about 24 million learners are at risk of not returning to school due to the economic fallout of the pandemic. Given these observations, UNESCO (2020) recommended the use of online learning to reduce the effect of global shutting 'down schools'.

Online learning becomes a solution to the COVID-19 negative impact on the education system or at least to mitigate serious consequences on the global education system. Online learning is when you take courses online instead of in a physical classroom. Most education institutions of several countries made a complete switch to full online teaching and learning strategy in early 2020 (Yeung 2020). Countries (including South Africa) started to implement online learning to mitigate the serious consequences of COVID-19 on students' academic performance. Online learning, is an opportunity created by the COVID-19 pandemic to use technologies and collaborative learning approaches on the digital platform across borders that could lead to safer, more sustainable, and more inclusive global learning. Harari (2018) in his book, *21 lessons for the 21st century* outlined how schools before the COVID-19 pandemic focused on the acquisition of traditional skills and memorization rather than on 21st-century skills such as critical thinking, collaboration, and adaptability. The adoption of online teaching and learning strategy focused on these 21st-century skills.

The emerging research in COVID-19 and online learning in higher education were based on the adaptations of individual institutions, teachers' adaptation, and the challenges they have faced (e.g. Bao 2020; Moorhouse 2020). Limited empirical studies were available in South African higher institutions on prospective mathematics teachers' perception of online learning concerning the COVID-19 pandemic era, hence the need for this research. Moreover, prospective mathematics teachers (PMT's) voices should be heard to evaluate this new learning strategy. PMT'S perceptions of online learning strategy that they have experienced will either motivate or hinder their learning outcome now and in their future teaching career. With this sudden shift away from the classroom in many parts of the globe, researchers are wondering whether the move to online learning becomes the catalyst that will create a new and more effective method of teaching and learning.

Purpose of the Research

This research explored the extent to which the Covid-19 pandemic era determines prospective mathematics teachers' perceptions of the need for using online learning in their mathematics education modules.

Research Question

This research responded to the following research question: to what extent did the Covid-19 pandemic era determine prospective mathematics teachers' perceptions of the need for using online learning in their mathematics education modules?

The Review of Literature

The global world is experiencing high growth in online learning strategies and the adoption of sophisticated digital technology in teaching and learning outside the classroom. Online learning was introduced to reduce possible differences in students' academic opportunities so that the COVID-19 pandemic will not lead to a more significant negative effect on students' academic achievement (United Nations, 2020). New South Wales Government (2020) observed that maintaining the engagement of students in online learning is very critical and difficult for effective learning. Ubah, Spangenberg, and Ramdhany (2020) research revealed limited access to digital technology as one of the problems on online learning because of the non-availability of personal computers that students can use to learn in the comfort of their homes. While some schools and governments have been providing digital equipment to their students for effective learning through online learning strategy, many are still concerned that

the effectiveness of digital technologies varies amongst age groups and academic levels (World Economic Forum, 2020).

To get the full benefit of online learning, there is a need for a concerted effort to provide a structured environment and go beyond replicating a physical class through video capabilities, instead, employ the use of a range of collaboration tools and engagement methods that promote learning (Behrendt & Franklin, 2014). Licorish, Owen, Daniel, and George (2018) revealed that the skillful integration of online learning has shown higher engagement and increased motivation towards learning, making learning fun and interesting. Recent studies (e.g. the conversation, 2018) have shown that teachers feel uncomfortable and less confident with the use of online learning in teaching and learning. Ubah, Spangenberg, and Ramdhany (2020) study revealed that prospective teachers' poor perception of technology usage in teaching and learning of mathematics could be attributed to poor internet facilities at home for learning. Based on the reviewed literature, there is no empirical gap in prospective mathematics teachers' perception of using online learning in mathematics education modules. Hence, this research explored the extent to which the Covid-19 pandemic era influenced prospective mathematics teachers' perceptions of the need for using online learning in their mathematics education modules.

Framework for Online learning

This research adapted Picciano's (2017) online learning model which operates best as a system of vigorous, connected parts, which may vary in terms of implementation by context. For a clearer understanding of the integrated online learning model, Figure 1 provided an example of the model as a representation of online teaching and learning strategy. The three major components for this online strategy are content, assessment/evaluation, and feedback. Other components of the model, such as reflection, collaboration, or discussion board to allow interaction among students were included but are not quite mandatory. In this model, students proceed at their own pace to complete the course as is typical in some distance education programs. However, Acquaro (2020) observed that the use of an integrated model of online learning is suitable for teachers in designing their content and effectively delivering their online lessons.

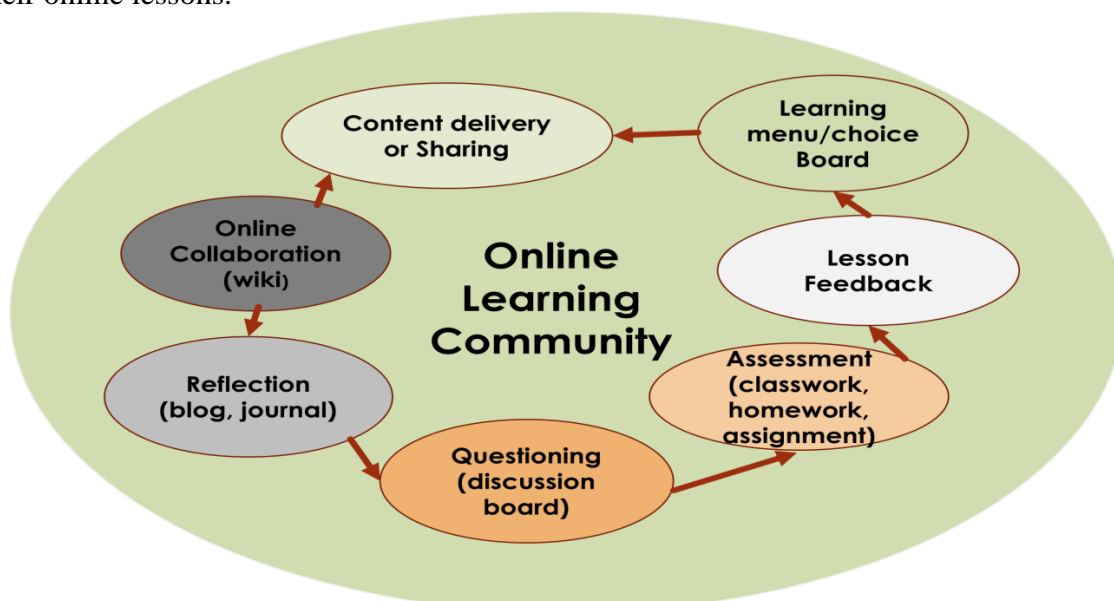


Figure 1. Integrated Model of an Online Learning Community

Content delivery is one of the primary drivers of instruction and there are many ways in which content can be delivered and presented. For instance, mathematics a subject of numbers, and space is best presented by the use of visual stimulation through an online learning strategy. Games, diagrams, and simulation have also evolved and now play a larger role in mathematics instructional content.

Collaboration using Wikis is an online resource edited by multiple users to easily share knowledge and teamwork has grown in popularity and are becoming essential in group projects and writing assignments. According to Fredericksen (2015), Wikis allow learners to create content that can be shared with other learners during and beyond the end of course content.

In online learning, reflection involves pedagogical activities that enabled learners to reflect on what they learn and to share their reflections with their teachers and peers to enrich their reflection. Appropriate tools for learners' reflection and other aspects of course activities include blogs and blogging.

Questioning is an important activity that aids teachers in examining what learners know, the extent of their knowledge, and to help redress their knowledge. A well-organized online discussion activity generally seeks to present a topic, and have learners respond to questions and provide their solution. However, for teachers who wish to concentrate on a specific topic, the baseline activity that involves questioning is the electronic discussion board.

Assessment of learning is viewed as the most significant segment of the online learning model. Papers, tests, tasks, and portfolios are among the significant techniques utilized to assess learners' performance and are handily done electronically. Online learning allows for more continuous involvement of assessment activities and provides a long-lasting, available record for teachers and students.

Feedback tells our students what effect their actions have on their learning goals. Here students will need to be assessed on how they were progressing with their learning. They should be guided with regular and timely feedback to determine how students were performing relative to a set academic goal. Feedback will determine if there is a need for reteaching of a lesson, adjustment of strategy, or redesign of content on the learning menu for an improved understanding.

Learning menus and Choice board: Learning menus are forms of differentiated learning that provided students with a choice in how they learn. The choice board is a graphic organizer that allows students to choose how they will learn content.

The seven components of the integrated model for Online learning described above form an integrated community of learning in which rich online interaction can be provided across all modules. Furthermore, not every course must incorporate all of the activities and approaches of the model. The pedagogical objectives of a course should drive the activities and, hence, the approaches to be utilized.

Methodology of Research

Research Design

An exploratory sequential mixed-method approach was used to explore the extent to which the COVID-19 pandemic era influences prospective mathematics teachers' perceptions of the need for using online learning in their mathematics education modules. This approach was

used in this research because it is characterized by an initial quantitative phase of data collection and analysis, followed by a phase of qualitative data collection with the final integration of the two data collected (Bermam, 2017).

Sample and Sampling Technique

This exploratory research was carried out with 42 graduating prospective mathematics teachers' that enrolled for a mathematics methodology module that formed part of their Bachelor in Education (B.Ed.) degree at a South African Higher Education Institution (HEI). This study used a purposive sampling approach to select 42 participants with the purpose to select information-rich cases whose research would answer the question under study (Ratcliff, 2016). Ritchie and Lewis (2003) remarked that purposive sampling is suitable for studies that involve sample units with particular features to enable a detailed exploration of the central themes studied.

Based on prospective mathematics teachers' responses to the questionnaire administered, three prospective teachers: Green, White, and Pink were conveniently sampled for semi-structured interviews to highlight their views on the use of online learning strategies in mathematics education modules. The interviews were audio-recorded and then transcribed in a verbatim manner by the researchers. To ensure reliability, the transcripts were re-checked by the researchers. To ensure credibility, member checking adopted where participants were given the transcripts to check and correct errors that might have occurred during transcriptions (Korstjens & Moser, 2017). Likewise, dependability was ensured through a good recording of the interviews.

Ethical considerations

Permission was granted by the HEI research office and an ethical clearance certificate was issued. The participants signed a consent form. The purposes of this research were explained at the beginning of the research and the participants were aware that participation was voluntary. However, all the prospective mathematics teachers who registered for the module agreed to participate in the research.

Instruments for Data Collection

This research employed two instruments for data collection; first is the use of a self-administered questionnaire (adapted from Venkatesh, Morris, Davis, & Davis, 2003) and a semi-structured interview. The questionnaire consisted of two sections; Section A consisted of five yes/no questions, while Section B consisted of 24 items 5-point Likert scale questionnaire with five possible answers ranging from 1 (strongly disagree) to 5 (strongly agree). Two post-doc fellows in the mathematics education discipline and the academic mentor ascertained the content validity of the questionnaire items. They checked on the content relevance to the research and appropriateness of each item. Moreover, the psychometric property of the questionnaire was tested using the Cronbach alpha technique, which resulted in a coefficient of 0.80.

The researchers did not follow a formalized list of questions to develop questions for the semi-structured interviews. The questions were asked based on the prospective teachers' response to the questionnaire items on their perceptions of the need for using online strategy in mathematics education modules.

Data Analysis

Analysis of data entailed the breaking down of the information gathered into elements to obtain responses to research questions (Sauro, 2015). The quantitative data were analyzed with descriptive statistics (frequency count) using the software package, SPSS version 25 as illustrated in Table 1 and Table 2. Qualitative data analysis from a semi-structured interview is thematically analyzed. The researchers permit the data to justify itself (Aspers & Corte, 2019).

Results

Overall summary responses of the participants' to the questionnaire items

In reporting the results, Table 1 showed responses of participants to 'Section A' (Yes or No responses) part of the questionnaire. Table 2 showed the responses of participants (based on the Likert scale) views on the need for using online learning in their mathematics education modules in order to determine their willingness to adopt online learning for their future teaching career.

Table 1. Participants' responses to 'Section A' part of the questionnaire

Questions	Frequency of Yes Responses	Frequency of No Responses
Do you have a computer at home?	32	10
Do you have the internet at home?	22	20
Are you computer literate?	42	0
Do you have an online course experience?	36	6
Do you prefer using online learning in your mathematics modules?	36	6
Are you willing to adopt online learning in your future teaching career?	36	6

The 42 participants that took part in this research had access to computers and the internet in the classroom. Thirty-two out of 42 participants indicated that they had computers at home, while 22 out of 42 participants had the internet at home (see Table 1). The table revealed a greater challenge to the use of digital technology in learning. However, all the students were computer literate while 36 participants possess online course experience. Thirty-six (36) participants responded that they preferred learning their mathematics education modules online and are willing to adopt online learning in their future teaching career, an indication of great excitement about the introduction of Education 4.0 in the learning mathematics modules. See Figure 2 for the graphical representation.

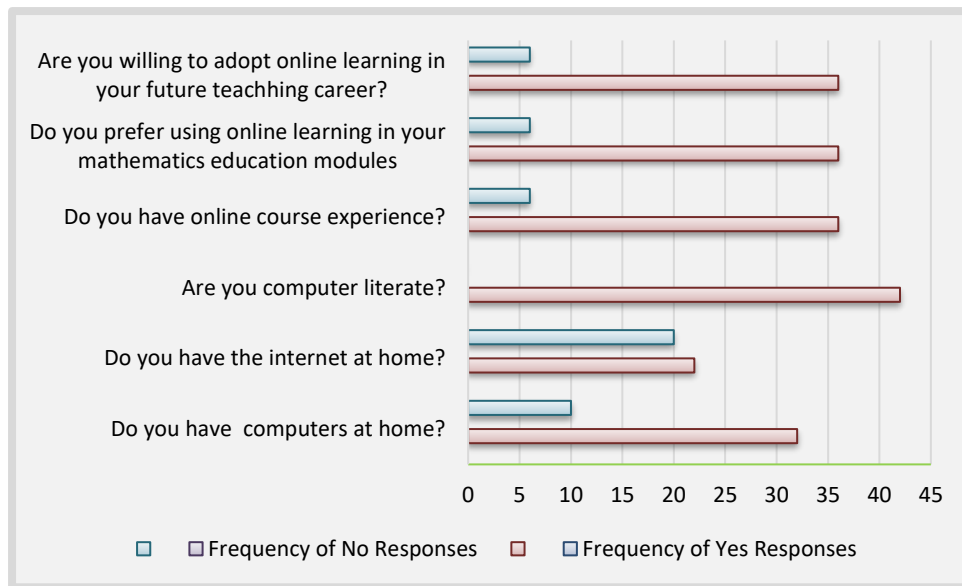


Figure 2. Participants' graphical responses to 'Section A' part of the questionnaire

Figure 2 is the graphical representation of the result in Table 1. The graph showed that more than half of the participants preferred learning mathematics education modules online. Table 2 showed the participants' responses to 'Section B' part of the questionnaire. It is important to understand that 'N' used in Table 2 stands for the number of questions in that section. In reporting the results, Table 2 shows the responses of prospective mathematics teachers' perceptions of learning mathematics education modules online.

Table 2. Result of participants' responses to a 24-item questionnaire

N	Questions	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1	During online courses, I can get help when I have questions.	5	2	3	30	2
2	Online instructors provide feedback to guide learning promptly.	6	3	2	28	3
3	Online courses provide a reflection strategy that allows students to develop critical thinking skills.	7	2	1	30	2
4	Online courses provide multiple activities for students to develop complex problem-solving skills.	6	4	2	29	1
5	Online courses utilize a variety of	8	4	2	25	3

	sources that assist student learning.					
6	Online courses facilitate learning in students of diverse learning styles.	5	4	1	30	2
7	Online courses are a good learning strategy because students learn at their own pace.	4	3	0	32	3
8	Generally, I understand module requirements better in an online environment.	5	2	2	30	3
9	Online learning improves learners' achievement and retention of concepts learned.	3	2	1	34	2
10	Because of Online Learning, I am more likely to get a good degree in mathematics education.	3	2	3	29	5
11	Online instructors provide explanatory feedback that facilitates learning.	4	3	2	30	3
12	Online courses assist in how to participate in online discussion forums and chats.	3	1	2	34	2
13	Through Online Learning, I like the flexibility of accessing the lesson content anytime online.	6	4	2	27	3
14	During online courses, students provided with many opportunities to interact with peers.	3	1	2	34	2
15	Online courses promote a student's	5	2	2	32	1

	desire to learn.					
16	The module content was too difficult to learn using online learning.	30	4	2	5	1
17	I am satisfied learning my modules online.	3	4	1	32	2
18	Am flexible in accessing the course content online at all times.	7	2	4	25	4
19	I have strong time management skills in learning my modules online.	5	3	4	27	3
20	I will adopt an online teaching and learning strategy in my future teaching career.	3	2	1	34	2
21	I have more opportunities to reflect on what I've learned in an online module.	4	2	2	30	4
22	I have the necessary infrastructures and facilities required for Online Learning	2	12	3	21	4
23	I do not have an interest in Online Learning.	31	5	2	2	2
24	Online learning provides reliable access to the internet and digital technology	5	5	2	27	3

Table 2, showed that 31 and 5 of the participants strongly disagree and agree respectively with the question “I do not have an interest in Online learning(question 23). Moreover, participants’ response to question 17 (I am satisfied learning my modules online) showed 34 participants’ acceptance of an online approach to teaching and learning of mathematics education. This is an indication that the online approach improves on students’ learning outcomes, opportunities to collaborate, flexibility in learning, and an improved understanding of mathematics education modules. However, 36 participants’ responded positively to question 20; I will adopt online teaching and learning strategy in my future teaching career. This finding concurs with the response to question 5 in Section ‘A’; where 36 participants prefer using Online learning in their mathematics education modules.

Results of participants' responses to semi-structured interview questions

Qualitative data analysis of the semi-structured interview questions was analyzed thematically. The objective of this research leads the researchers to permit qualitative data to justify itself (Aspers & Corte, 2019). The extract from the semi-structured interview of three prospective mathematics teachers; Green, White, and Pink was shown below. Box 1 was the dialogue between the researchers (A) and Green. Box 2 was the dialogue between the researchers (A) and White, while Box 3 was the dialogue between the researchers (A) and Pink.

Box 1. Dialogue between the first participant (Green) and the researchers (A)

A: Do you prefer online courses to your mathematics education modules?
 Green: Before the introduction of online learning, I struggled to understand my mathematics modules but now I can comfortably study my modules online and pass well.
 A: As a prospective mathematics teacher, do you feel you will want to use online teaching and learning strategies in your future teaching career?
 Green: Yes, and I will adopt it in my teaching strategy so that mathematics will be fun and interesting.
 A: What challenge(s) do you encounter when using online strategy in your mathematics modules?
 Green: Technical challenge and non-availability of data.
 A: What frustrations do you think you will encounter using online strategy in your future teaching career?
 Green: None for now until I start my career but I will use all available resources to incorporate online learning since most learners use android phones.
 A: Ok, what advice do you have for mathematics teachers teaching in schools?
 Green: My advice is that they should adopt an online strategy in mathematics instruction because it is an efficient teaching approach.
 A: Good. Do you collaborate with peers?
 Green: Yes.

Box 1 showed that Green preferred the online strategy because he passes his modules with good grades. Green's preference for online strategy is attributed to his collaboration among his peers. Green recommends that the adoption of an online strategy for all mathematics teachers will create fun in the cause of learning mathematics in schools. He identified the technical challenge and cost implication of data as a weakness to his effective use of online teaching and learning strategy. Green did not identify any challenge in his future teaching career. He strongly believes he will adopt an online strategy as long as the learners have their android cell phones. He advised teachers to adopt online learning because it is an efficient teaching and learning strategy.

Another prospective mathematics teacher 'White' indicated in the questionnaire that he enjoyed learning his mathematics education modules online. This assertion was revealed in the interview extract below.

Box 2. Dialogue between second interviewee (White) and the researchers (A)

A: Do you think that online learning is good for learning mathematics modules?
 White: Yes, because each student learns at his/her own time and pace. It makes learning very interesting and easy. I can now do my assignments perfectly well and get good grades.
 A: Good. Do you collaborate with your peers in studying your modules?
 White: Yes, in solving homework, assignments, and projects, we do it together on Wiki and

WhatsApp chat.

A: White, as a prospective mathematics teacher that you are, do you feel you will want to adopt an online strategy in your future teaching career?

White: Sure. I will adopt that when I start my teaching career.

A: What challenges did you encounter when learning your modules online?

White: The only challenge I encounter is how to organize my studies.

A: What difficulties do you envisage by adopting an online strategy in your future teaching career?

White: I need proper training on how to design my lessons.

A: Ok. What advice do you have for mathematics teachers?

White: I will advise them to adopt an online strategy in teaching and learning of mathematics because it will improve on learners' performance and interest.

The extract in Box 2, clearly showed that White is comfortable with learning mathematics modules online. White believes that online strategy is adopted in all mathematics instruction because it makes learning easy and interesting. He seemed to be comfortable with the support he gets from his peers concerning any difficulty he might experience in the process of learning his modules. He stated that his lessons as a practicing teacher would be interesting and easy for his learners to learn because he will adopt an online strategy. He advocated for training further training on online lesson design as his challenges will be on the lesson organization.

The third interviewee is 'Pink'. His responses to the questionnaire showed he was not comfortable learning mathematics education modules online. The interview extract is as follows:

Box 3. Dialogue between Pink and the researchers (A)

A: Hello Pink, from your experience, do you prefer learning mathematics education modules online?

Pink: I do not think so, because I like seeing the teacher teach me one and one then online teaching

A: Have you ever tried online tutorials?

Pink: Yes, I have watched a tutorial on YouTube once but I did not understand the lesson better. I prefer the traditional method of instruction.

A: What is your challenge with online tutorial lessons?

Pink: (He laughed). The tutors are too fast and the English they are using is hard to understand. If it is in our local English language, it could make sense to me.

A: What advice do you have for mathematics teachers?

Pink: mmm, my advice to them is that they should encourage their learners to study well. I advise the teachers to learn the best way to design their lessons so that the lesson will be interesting and improves on their learners' achievement.

From the interview extract in Box 3, Pink stated that online strategy is not good for learning because there is no physical contact with the lecturer at all times, unlike the strict face-to-face traditional method. Pink said that in Online Learning, the tutors are fast and the language of instruction is hard and did not make sense to him. Moreover, Pink stated that with the traditional approach, the lecturer could use local language for clarity. He advised practicing mathematics teachers, to learn and use the best teaching and learning strategy for learners to improve their achievement in mathematics.

Discussion

The results obtained from the research findings align with the purpose of the research. The major findings revealed that prospective mathematics teachers perceived that learning mathematics education modules online have positive impacts on their learning outcomes and hence, should be an effective tool for teaching mathematics in their future teaching career. Online learning improves the participants' opportunities to collaborate, enhanced critical thinking skills, and a better understanding of mathematics education modules. This finding agrees with Rizki and Priatna's (2019) assertion that modern technology in teaching and learning requires the acquisition of critical skills and improved performance. The quantitative data also revealed that 36 out of 42 participants preferred learning mathematics education modules online. This assertion concurs with the observation made by Behrendt and Franklin (2014), UNESCO (2020) that the use of online learning is an opportunity for collaborative learning approaches that promote learning. Contrarily, (The conversation, 2018) has shown that teachers feel uncomfortable and less confident with the use of technology in teaching and learning.

The qualitative data revealed that the participants perceived that online learning is good for improved performance in mathematics education modules. This finding is consistent with Siyepu (2018) research finding which revealed that virtual learning improved students' academic performance. Moreover, White indicated that collaboration among his peers was attributed to his improved academic performance. This assertion concurs with Shand and Glassett Farrelly (2017) which stated that students' improved academic performance could be attributed to their collaboration among peers.

However, any negative effect in the participants' response to the use of online learning strategy could be attributed to the online language of instruction as observed by Pink during the interview. This observation calls for the need to introduce the use of artificial intelligence in learning mathematics modules. Artificial intelligence will help to produce artificial tutors that could answer such questions required by Pink during the online tutorials. This finding concurs with Yang and Zhang (2019) who observed that physically personified robots may bestow virtual interactions, promote psychomotor, affective, and cognitive learning outcomes as well as attainment of greater learning outcomes similar to those of human teaching.

Conclusion

This research explored the extent to which the COVID-19 pandemic era determined prospective mathematics teachers' perceptions of the need for using online learning in their mathematics education modules. The main finding of this research has shown that prospective mathematics teachers' improved performance in mathematics education modules should be attributed to online learning. The outcome of this research also revealed that prospective mathematics teachers through online learning demonstrated a deeper understanding of content and displayed higher-order thinking skills required for their future teaching career. This research produced mathematics teachers that are ready to embrace online learning and to make a difference in their future teaching careers and professional learning communities. This research gave a 'voice' to PMTs, a necessary ingredient relevant for effective implementation and use of online learning. PMTs' voices concerning their experiences with online learning will either motivate or hinder the learning outcome and their future teaching career.

If it is plausible that many teachers teach as taught, then teacher education should provide unique opportunities to inculcate a technology-enhanced instructional approach carried over

to everyday classroom practices. They should also prepare teachers who will be digitally literate to invigorate instruction using an online learning strategy for effective teaching and learning of school subjects. The research sample of this research was limited to one higher education institution, caution should be applied to generalizations drawn from this research. The researchers recommended that prospective mathematics teachers should be provided with technical support and training for them to engage meaningfully in the online learning strategy which research has shown. Comparative effect of online learning in selected South African urban and rural higher education institutions: Insight from COVID-19 is a suggested title for further research.

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TEACHERS' PERCEPTIONS ABOUT ENGAGING FATHERS IN THE EARLY EDUCATION OF THEIR CHILDREN: A QUANTITATIVE RESEARCH APPROACH

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Abstract

This study explored teachers' perceptions about engaging fathers in the early education of their children in one Education District in the Eastern Cape Province of South Africa. Descriptive survey research, in which a sample of 78 teachers was involved, guided the study. Teachers' perceptions Questionnaire was used for data collection. Mean and analysis of variance were used to analyse the data. It was revealed that teachers had positive perceptions about the engagement of fathers in early childhood care and education. Conclusively, fathers' engagement in early childhood care and education is paramount in children's early education. It was recommended that fathers should be engaged to shoulder properly their responsibilities in the early education of their children.

Keywords: *Engagement, Early Childhood Care and Education, Teachers' perceptions*

Introduction

Despite that the proper upbringing of children depends on the responsibilities of both mothers and fathers, the engagement of South African fathers is insignificant compared to that of the mothers. Significant roles are played by fathers in children's social, emotional, and behavioral development (Lamb & Lewis, 2013; Panter-Brick et al., 2014 as cited in Chacko, Fabiano, Doctoroff & Fortson, 2018). In line with the above, Ramachandani et al. (2013) found that when fathers are actively involved in lives of their children, there will be fewer disruptive behavior problems over time. Not minding the significant impact of fathers' roles on the education of the children, literature shows that fathers are not well engaged in early childhood education in South Africa. According to Mufutau (2015) and Clyde (2016), fatherhood roles are not fully practiced in South Africa, most especially for the young fathers who became parents while at school due to pre-marital sex and were, therefore, incapable to be involved in the lives of their children.

Theoretical background of the study

This study was anchored on Urie Bronfenbrenner's (1979) Ecological System Theory. Bronfenbrenner (1979) believes that proper consideration of the entire ecological system in which growth takes place helps in the understanding of human development. Bronfenbrenner's theory defines complex 'layers' of the environment, each affecting a child's development. The "bioecological system theory" calls attention to the fact that a child's biology is a primary environment stimulating his or her development. Thus, to study a child's development, there is the need to consider both the child and the immediate environment in relation to the larger environment.

Bronfenbrenner's (1979) bio-ecological system theory believes that the main relationship needs to be with someone who can offer a sense of caring that is meant to last a lifetime. This relationship must be promoted by a person or people within the immediate sphere of the child's influence. Thus, the researchers used the tenets of this theory to explore teachers' perceptions about engaging fathers in their children's early education.

Review of related empirical studies

Morgan and Young (2017) indicated that healthy behavior in children depends on fathers' parenting practices but the evidence base is limited. Improvement in some fathers' behavior appeared to contribute to increased feelings of safety and wellbeing within some families (McConnell, Barnard & Taylor, 2017). Rominov et al. (2017) found that fathers' active engagement in a child's upbringing is associated with long-term benefits for the father, their partner, and their child. Furthermore, Kadar-Satat, Szaboki, and Byerly (2017) indicated that school staff believe in the active participation of fathers in school to achieve the best education outcomes for children. One of the beneficial factors in young children's learning and development is active family involvement (Ancell, Bruns & Chitiyo, 2018). Thus, children perform better in school and are less likely to develop behavioral difficulties when fathers are actively involved (Noggle, 2019).

Morgan et al. (2019) found that meaningful engagement of fathers increases physical activity behaviour in preadolescent girls. Despite the American Academy of Paediatrics recommendations, paediatric primary care providers do not routinely engage fathers in care (Allport et al., 2019). Rahmah (2019) found that fathers with young children in Indonesia have positive attitudes towards their children's education but the domination of female presence in a childhood education setting is limiting fathers to participate in child education.

The foregoing has shown the educational implications of fathers' engagement in early childhood care and education. However, there is a paucity of empirical evidence on the perceptions of principals and teachers on the engagement of fathers in the education of the children. Thus, the researchers sought to explore teachers' perceptions about engaging fathers in children's early education in one Education District in the Eastern Cape Province of South Africa.

Objectives of the study

The study sought to determine the:

1. Teachers' perceptions about engaging fathers in children's early education.
2. Influence of race on teachers' perceptions about engaging fathers in children's early education.
3. Influence of marital status on teachers' perceptions about engaging fathers in children's early education.

Research Questions

1. What are teachers' perceptions about engaging fathers in children's early education?
2. What is the influence of race on teachers' perceptions about engaging fathers in children's early education?
3. What is the influence of marital status on teachers' perceptions about engaging fathers in children's early education?

Hypothesis

The following hypotheses were tested at 0.05 level of significance.

H₀₁: There is no significant influence of race on teachers' perceptions about the engagement of fathers in early childhood education provisioning.

H₀₂: There is no significant influence of marital status on teachers' perceptions about the engagement of fathers in early childhood education provisioning.

Methods

Research Design

The design of the study was descriptive survey research. According to Creswell (2014) survey design provides a quantitative description of trends or opinions of a population by studying a sample of that population. This design has been used by Okeke, Ugwuanyi, and Mufutau (2020), Okeke, Okeke, and Ugwuanyi (2020), Ugwuanyi et al. (2020), Eze, Ugwuanyi and Okeke (2020) in similar studies.

Participants

A sample of 78 teachers drawn from the population of teachers of preschools (0-4years) and Grade R aspects of foundation phase in King William's Town Education District in the Eastern Cape Province participated in the study. The sample was composed by selecting eight (8) schools using a stratified random sampling technique at the first stage. Simple random sampling technique was used to select 78 teachers from the selected schools in the second stage.

Instrumentation and procedure

Teachers' perceptions Questionnaire structured on a 4-point scale of Strongly Agreed (SA), Agreed (A), Disagreed (D), and Strongly Disagreed (SD) was used for data collection. The instrument had 20 item statements relating to the perceptions of teachers on engaging fathers in the children's early education.

Instruments validation

To ensure the face validity of the instrument, copies of the instrument were given to experts in instrument development for their constructive criticisms. The experts looked at the instrument in terms of the clarity of items, simplicity of vocabulary, and relevance of items to the research objectives. Based on the observations and corrections of these experts, the instrument was modified accordingly. To ensure the reliability of the instruments, the field test of the instruments was conducted. The internal consistency reliability index of the items of the instrument was obtained to be 0.94 using Cronbach's alpha method.

Ethical measures

Ethical clearance was obtained through the Faculty Research Ethics Committee (FREC) and University Research Eastern Committee (UREC) of one Eastern Cape-based University, as well as a permission letter from the Eastern Cape Department of Basic Education, Bisho, Zwelitsha to conduct the study in the schools. The researchers endeavoured to act within the ethical principles and rules during the study.

Data analyses

Data were analysed using mean and analysis of variance (ANOVA). Mean was used to answer the research questions while ANOVA was used to test the null hypotheses at 5% probability level.

Results

Research Question One: What are teachers' perceptions about the engagement of fathers in early childhood care and education provisioning?

Table 1: Teachers' perceptions about the Engagement of Fathers in ECCE Provisioning
n = 78

S/N	Item Statement	Mean	SD	Remark
1	Fathers should visit school to check their children's progress.	2.98	.56	Agree
2	Fathers should be interested to be a resource person in the classroom as story reader.	3.56	.87	Agree
3	Fathers should be encouraged to share knowledge and skills with school's staff and children.	3.23	.81	Agree
4	Fathers should feel free to seek for assistance from the school for the child's education.	3.05	.56	Agree
5	Fathers are expected to have aspirations for their children's educational improvement.	2.96	.42	Agree
6	Fathers should have greater awareness of children educational progress.	3.67	.65	Agree
7	Fathers are expected to know about what the school is teaching the child.	3.32	.71	Agree
8	Fathers should perceive themselves as educators at home in their children's live.	3.73	.89	Agree
9	Fathers should establish and maintain on-going and productive communication with school.	3.61	.41	Agree
10	Fathers should contribute to school aims/policies/procedures.	2.95	.84	Agree
11	Fathers should contribute to the progress of their children school.	2.91	.63	Agree
12	Fathers should use the opportunities during "drop off" and "pick up" time to know their child's teacher.	3.07	.85	Agree
13	Fathers should encourage school visitation to the home.	2.89	.89	Agree
14	Fathers should actively engage in school matters.	3.31	.63	Agree
15	Fathers in the school community are aware of their importance to be engaged in their children education.	3.42	.56	Agree
16	Fathers should appreciate being engaged in school's activities.	3.22	.69	Agree
17	Fathers are expected to have the same vision for the child like that of the school.	3.48	.84	Agree
18	There should be mutual respect between fathers and school.	3.15	.76	Agree
19	Fathers are more aware of school aims and objectives.	3.06	.75	Agree
20	Fathers should develop good relationships with school's staff.	3.12	.42	Agree
Weighted Average		65.09	9.76	Agree

Table 1 shows the mean perceptions ratings of teachers about engaging fathers in children's early education. The analysis showed that the mean ratings of teachers on items 1 to 20 are more than 2.50 criterion mean. This implies that teachers agree to the statements of the items as ways of engaging fathers in children's early education. The overall mean rating of 65.31 with a standard deviation of 9.76 implies that teachers have positive perceptions of fathers' engagement in ECCE provisioning.

Research Question Two: What is the influence of race on the teachers' perceptions about engaging fathers in children's early education?

Table 2: Mean analysis of the perceptions of teachers about engaging fathers in children's early education

Race	n	Mean	Std. Deviation	Std. Error
Black	65	67.00	11.58	1.43
White	8	67.12	12.66	4.47
Coloured	2	62.57	4.24	3.00
Indian	3	63.66	8.32	4.80
Total	78	65.09	9.76	1.32

Table 2 shows that Black teachers had mean perception rating of 67.00 with a standard deviation of 11.53, White teachers had mean perception rating of 67.12 with a standard deviation of 12.66, Coloured teachers had mean perception rating of 62.57 with a standard deviation of 4.24 while the Indian teachers had mean perception rating of 63.66 with a standard deviation of 8.32. This indicates that teachers of the White race had the highest mean perception followed by the teachers of the Black race.

H₀₁: There is no significant influence of race on teachers' perceptions about engaging fathers in children's early education.

Table 3: Analysis of variance of the influence of race on teachers' perceptions about engaging fathers in children's early education

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	746.407	3	248.802	1.866	.143
Within Groups	9865.542	74	133.318		
Total	10611.949	77			

Table 3 shows that there is no significant difference in the mean perception ratings teachers about engaging fathers in children's early education based on their race, $F(1, 74) = 1.866$, $p = .143$. Therefore, teachers had positive perceptions about engaging fathers in children's early education irrespective of their race.

Research Question Three: What is the influence of race on teachers' perceptions about engaging fathers in children's early education?

Table 4: Mean analysis of the perceptions of teachers about engaging fathers in children's early education based on marital status

Marital status	n	Mean	Std. Deviation	Std. Error
Married	46	66.46	9.43	1.92
Single	24	65.65	12.83	1.89
Divorced	8	63.24	11.93	4.22

Total	78	65.09	9.76	1.32
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Table 4 shows that the mean perception of the married teachers is 66.46 with a standard deviation of 9.43, the single teachers had mean perception rating of 65.65 with a standard deviation of 12.83, while the divorced teachers had mean perception rating of 63.09 with a standard deviation of 11.93. This indicates that teachers who are married had the highest mean perception about engaging fathers in children's early education, followed by those who are single.

H₀₂: There is no significant influence of marital status on teachers' perceptions about engaging fathers in children's early education.

Table 5: Analysis of variance of the influence of race on teachers' perceptions about engaging fathers in children's early education

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	160.181	2	80.090	.575	.565
Within Groups	10451.768	75	139.357		
Total	10611.949	77			

Table 5 shows that there is no significant difference in the mean perception ratings of teachers about the engagement of fathers in the early childhood education provisioning, $F(2, 75) = .575, p = .565$. Therefore, all the teachers who participated in the study had positive perceptions about engaging fathers in children's early education irrespective of their marital status.

Discussions

The study sought the perceptions of teachers about engaging fathers in ECCE provisioning. The results revealed that the teachers had positive perceptions of engaging fathers in children's early education. For instance, teachers agreed that fathers should visit the school to check their children's progress; fathers should feel free to seek for assistance from the school for the child's education; fathers are expected to have aspirations for their children's educational improvement; that fathers should have a greater awareness of children's educational progress; fathers should perceive themselves as educators at home in their children's lives and fathers should establish and maintain ongoing and productive communication with school among other views. Despite these positive perceptions, studies have shown that most fathers in South Africa are uninvolved in the early education of their children (Mufutau, 2015; Clyde, 2016; Okeke, 2018).

These findings might be as a result of the fact that the teachers value education and can give whatever it takes to educate their children right from an early stage. In line with that, Burton and Osborne (2014) observed that the principals and teachers are knowledgeable about the fact that African fathers cherish their children and like to educate them because children are seen as the future of the family. These findings are in line the findings of previous empirical studies. Baker (2014) found that African American fathers who engaged in more frequent shared book reading, telling stories, singing songs had early childhood children with better reading and math scores. According to Ihmeideh (2014), in the context of taking care of

children in Jordanian society, the primary responsibility relies on mothers' role while fathers are going to be the one who is providing the family.

Glynn and Dale (2015) found that father participation is important because fathers have a positive impact on both child development and behaviour. Mathwasa and Okeke (2016) found that fathers' participation in their children's education is germane to effective early childhood education in schools. Foster et al. (2016) found that the bulk of the learning environment that children experience is from mothers' perspectives, not the fathers. Morgan and Young (2017) indicated that promoting healthy behaviour in children is dependent on fathers' parenting practices. Kadar-Satat, Szaboki and Byerly (2017) indicated that staff believes that achieving the best education outcomes for children is dependent on the active participation of fathers.

One of the beneficial factors in young children's learning and development is active family involvement (Ansell, Bruns & Chitiyo, 2018). Thus, children perform better in school and are less likely to develop behavioral difficulties when fathers are actively involved (Noggle, 2019). Morgan et al. (2019) found that meaningful engagement of fathers increases physical activity behaviour in preadolescent girls. Allport et al. (2019) found that despite the American Academy of Paediatrics recommendations, paediatric primary care providers do not routinely engage fathers in caring for their children's education. Rahmah (2019) found that fathers with young children in Indonesia have positive attitudes towards their children's education but the domination of female presence in a childhood education setting is limiting fathers to participate in child education. These findings have educational implications. The findings of this study might equip fathers with the necessary information needed for them to take active roles in the education of their children and provide the necessary support for their optimal and holistic development. National and Provincial governments as well NGOs might use the result of the study for futuristic plan of programs for fathers.

Conclusion

This study revealed that teachers had positive perceptions about engaging fathers in children's early education. Teachers are of the view that fathers should shoulder their responsibilities by discussing the importance of good education with their children.

Recommendations

Based on the findings of the study, the following recommendations were made;

- Fathers should be made to understand that their active participation in the early education of their children is paramount.
- The government of South Africa should advocate for ECCE policies that layout concrete commitment and guidelines for fathers' engagement in their children's educational achievements.
- A special day event should be organised for fathers to motivate them in taking active engagement in the education of their children.

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POOR PARENTAL INVOLVEMENT IN CHILDREN'S EDUCATION AND DEVELOPMENT IN NIGERIA: FACTORS AND CONSEQUENCES

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Abstract

This study explored the factors responsible for and the consequences of poor parental involvement in children's education and development among urban and rural dwellers in Nigeria. Three research questions and three null hypotheses guided the study. A descriptive survey research design was adopted using a sample of four hundred (400) parents (220 urban and 180 rural). Data were collected using Parents' Views on Involvement Questionnaire (PVIQ). Using Cronbach Alpha method, an overall reliability index of 0.87 was obtained. Data collected were analyzed using mean and t-test. The findings of the study revealed personal factors as well as environmental factors responsible for poor parental involvement in children's education and development in both urban and rural areas. The findings also revealed a number of consequences of poor parental involvement as identified by both urban and rural parents. Further analysis revealed that there was no significant difference in the mean responses of urban and rural parents on the personal and environmental factors responsible for poor parental involvement as well as the consequences of poor parental involvement in children's education and development. Based on the findings of this study, the researchers recommended that: the Universal Basic Education Commission should develop parent education programmes to equip parents with the necessary information on the developmental and learning needs of children as well as areas of involvement in the education and development of children. Also, Federal Government of Nigeria should ensure that public services are promoted especially in provision of basic social amenities for both urban and rural dwellers. Finally, schools should also be made to promote effective home-school collaboration.

Keywords: *children's education, consequences, factors, parental involvement, poor parental involvement*

Introduction

Development of the whole child is a gradual and systematic process, and demands active involvement among the key players in the life of children. Among the key players in children's education and development is the family and parents in particular (Mabuza & Mafumbate, 2019; Ugwu & Onyekonwu, 2015). Parents as the primary socializing agents for children have significant role to play in ensuring all round development of children. According to ChangingMinds.Org (2018), the responsibility of making necessary provisions available for growing children lies more with parents. In other words, it can be argued that development, school readiness and academic achievement have a link with the quality of care and support a child receives from parents. In line with that, Harry (2016) pointed out that school children must feel safe and secure through the provision of their basic needs: food; shelter; love; clothing; medical care; emotional support; protection from harm among others to do well in school. Therefore, parental involvement in the education of children is imperative for the attainment of the objectives of such education programmes.

Parental involvement refers to parent behaviours related that can be a manifestation of their commitment to their child's development and educational affairs (Pobbi, 2020). According to Yamamoto, Holloway and Suzuki (2016), active involvement of parents in children's

education and development not only motivates children and increases their academic achievement, but also encourages the teachers/caregivers and contributes to the emotional stability of children. However as important as education is for growing children, Eriba (2011) and Tombowua (2013), observed poor state of pre-primary and primary education in Nigeria in terms of quality of instruction, learning readiness on the part of children and learning outcomes. Mghasse and William (2016) attributed the ugly development majorly to poor involvement of parents in children's education both in rural and urban areas. The downward trend of parental involvement may not be healthy for the growing children especially in developing countries like Nigeria. According to Thomas (2015), a number of factors may be responsible for the downward trend in parental involvement in child education and development. The factors may be personal and / or environmental each impacting negatively on children's development and learning. With poor parental involvement, children may fail to develop social competence and may not adjust well in school. In line with the above, Ukweze (2016) observed that in Enugu State of Nigeria, pre-schoolers are often observed displaying obvious signs of poor school adjustment. Ebizie, Njoku and Omeje (2018) also identified some signs of poor school adjustment among school children in Enugu State which include: not wanting to part with parents or family members; refusing to stay calm in class; finding it difficult to play with peers; crying in class; displaying learning difficulties and emotional stress among others. This may be a product of poor attachment behaviour inculcated in children from home early in life possibly due to poor parental involvement in the child's overall development. This study was therefore anchored on parental attachment theory propounded by Bowlby (1980).

Theoretical Background of the Study

The basic tenet of Bowlby (1980) parental attachment theory is that children form strong emotional bond with another person (parents or caregivers) during childhood with lifelong consequences. Bowlby believes that appropriate parenting (warm, sensitive and emotionally available) enables the child to form a secure attachment behaviour pattern necessary for socio-emotional stability and general wellbeing throughout life. On the other hand, an insecure and emotionally distanced parenting and neglect of the child's developmental and learning needs may lead to insecure attachment behaviour pattern which is a critical risk factor for a number of developmental issues and learning difficulties among children. Bowlby's theory therefore is relevant to the present study as it points to the fact that poor parental involvement in children's education and development may explain a number of learning difficulties and developmental issues affecting children in Nigeria. Ebizie, Njoku and Omeje (2018) also adopted Bowlby (1980) in their study and observed that parental involvement in children's academic activities correlated significantly with academic adjustment and social competence among pupils. Their recommendations included that parental involvement should be encouraged and motivated. The theory therefore is relevant in studying the factors responsible for as well as the consequences of poor parental involvement in children's education and development.

Review of related empirical studies

Several research evidences have revealed significant positive correlation between parental involvement and positive outcomes in children's education and development (Mutodi, 2014; Chukwu, 2015). Also, Ebizie, Njoku and Omeje (2018) observed significant positive correlation between parental involvement and pupils' academic adjustment and social competence. However, Ebizie, Njoku and Omeje further observed that family structure or family type influenced the result as the involvement of single parent had a weak positive relationship. Mutodi (2014) also observed that parents' involvement through home works,

creating conducive home environments for studying and motivating and setting realistic expectations enhance children's educational outcomes. While research evidence abounds on the positive outcomes of active parental involvement, evidence from literature also attest to the fact that gender and location of the parents plays significant role as evidenced by Mathwasa and Okeke (2016). The finding from Mathwasa and Okeke (2016) for instance indicated that the bulk of the parental involvement recorded came from the mothers. Confirming the influence of gender and the need for active involvement of both parents, Kadar-Satat, Szaboki and Byerly (2017) found that achieving the best education outcomes for children is dependent on the active involvement of fathers in school and recommended that fathers should be actively involved in the education of their children. Corroborating the influence of gender, Arowolo, Arowolo and Adaja (2018) identified gender-based factors (pattern of behaviour, belief, preferences, customs and tradition) and socio-cultural environment as contributors to gender differences in parental involvement in children's education and development.

With the barrage of research evidences supporting active involvement of both parents in all round development of children, the big question remains how active they have been. Although from the study by Mathwasa and Okeke (2016), mothers were seen as being more involved in children's education and development, Ngwoke (2019) observed poor involvement of both parents in children's education and development. Ngwoke further observed poor parental involvement among urban and rural dwellers. In the same vein, some earlier studies observed poor involvement of parents and identified poverty and illiteracy as factors responsible (Singh, Mbokodi & Msila, 2004; Lemmer, 2007). According to Ngwoke (2019), the poor involvement for both urban and rural parents could have been occasioned by a number of factors ranging from poverty, increasing high cost of living, the modern child rearing practices,; increasing involvement of both parents in employment outside home; over reliance on digital technology, poor government policy implementation, inadequate social support for parents; increasing parental stress among others. On the other hand, Ancell, Bruns and Chitiyo (2018) observed that poor parental involvement was not an indication of lack of interest but that the school failed to collaborate with parents. Whatever factors that may be responsible, the consequences may be highly disastrous for the children, the family, the school and the society in general irrespective of location.

From the foregoing, it is evident that parental involvement in children's education and development in Nigeria has not been satisfactory both for urban and rural dwellers. However, research has not provided clear evidence of what factors are responsible and the consequences of such poor involvement by parents who are supposed to be one of the major key players in children's education and development. The present researchers therefore sought to find out directly from parents, the factors responsible and the consequence of poor parental involvement in children education and development.

Objectives of the Study

The study had the following as its objectives:

1. Identifying the mean responses of urban and rural parents on the personal factors responsible for poor parental involvement in children's education and development.
2. Identifying the mean responses of urban and rural parents on the environmental factors responsible for poor parental involvement in children's education and development.

- Identifying the mean responses of urban and rural parents on the consequences of poor parental involvement in children's education and development.

Research Questions

The following research questions guided the study:

- What are the mean ratings of urban and rural parents, on the personal factors responsible for poor parental involvement in children's education and development?
- What are the mean ratings of urban and rural parents on the environmental factors responsible for poor parental involvement in children's education and development?
- What are the mean ratings of urban and rural parents on the consequences of poor parental poor involvement in children's education and development?

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

- Ho1:** There is no significant difference in the mean ratings of urban and rural parents on the personal factors responsible for poor parental involvement in children's education and development.
- Ho2:** There is no significant difference in the mean ratings of urban and rural parents on the environmental factors responsible for poor parental involvement in children's education and development.
- Ho3:** There is no significant difference in the mean ratings of urban and rural parents on the consequences of poor parental involvement in children's education and development.

METHODOLOGY

Research Design

This study adopted a descriptive survey research design. Creswell (2014) posited that survey research design provides a quantitative description of the opinions of a population by studying a sample of that population. A pure quantitative research methodology was adopted in this study. According to Creswell (2014), quantitative methods emphasized objective measurements, and the statistical analysis of data collected through surveys.

Participants

A sample of 400 parents was drawn from the population of all the parents of children in early childhood education (0-4); pre-primary education (5-6) and primary education (6-11plus) in the 17 Local Government Areas (LGA) of Enugu State, Nigeria. Multi-stage sampling procedure was used to arrive at the sample size. At the first stage of sampling, two LGAs were selected using simple random sampling technique. At the second stage, stratified simple random sampling was used in selecting 220 urban and 180 rural parents that made up the sample for the study. Taken together, the sample comprised 170 fathers and 230 mothers.

Table 1: Sample distribution by Location and gender

Variables		<i>Freq</i>	<i>%</i>
<i>Location</i>	Urban	220	55%
	Rural	180	45%
<i>Position</i>	Father	170	42.5%
	Mother	230	57.5%

From Table 1, it can be seen that 55% of the respondents were urban residents while 45% resided in the rural areas. By virtue of position, location notwithstanding, fathers constituted 42.5% while mothers constituted 57.5%.

Instrumentation

Parents' Views on Involvement Questionnaire (PVIQ) adapted from Parental Involvement Model by Walker et al (2005) was used for data collection. The PVIQ had two sections. Section A sought information on the personal data of the respondents while section B had three clusters to cover the three main objectives of the study. Each cluster of Section B was based on a rating scale of a modified 4-point Likert type rating scale of Strongly Agree, Agree, Disagree and Strongly Disagree. Copies of the questionnaire were administered directly to parents by the researchers accordingly.

Validation and reliability

To ensure the validity of PVIQ, it was subjected to validity test by giving copies of it to three specialists for their constructive criticisms. Also, to ensure the reliability of the instrument, PVIQ was pre-tested in a field study and the data collected from the pre-test was used to establish the internal consistency reliability index of 0.87 for the instrument using Cronbach Alpha method.

Ethical Measures

The researchers obtained ethical clearance through the Faculty Research Ethics Committee (FREC) of the Faculty of Education, University of Nigeria, Nsukka. Besides, the participants were served with informed consent forms prior to the commencement of the data collection.

Data Analysis

Data collected were analysed using mean and standard deviation to answer the research questions and t-test of independent samples to test the null hypotheses at 0.05 level of significance.

Results

Research Question 1: What are the mean ratings of urban and rural parents, on the personal factors responsible for poor parental involvement in children's education and development?

Table 2: Personal factors responsible for poor parental involvement in children's education and development

S/N	Item Statement	Mean	SD	Decision
1	Parents lack appropriate information on the developmental needs of children	3.43	.44	Agree
2	Parents lack appropriate information on the learning needs of children	3.60	.58	Agree
3	Parents are ignorant of the relevant aspects of getting involved in children's education and development	3.40	.66	Agree
4	Parents lack relevant skills for helping out with children's homework	3.35	.79	Agree
5	Parents don't have enough time to attend to school invitations outside normal parents / teachers' meeting	3.15	.72	Agree
6	Parents not having enough money to provide what children	2.85	.85	Agree

	need in the school			
7	Parents being too busy at work, in the office and.....	3.30	.64	Agree
8	Both parents having to work to make ends meet	3.12	.89	Agree
9	Parents are often stressed up at work	2.70	.95	Agree
10	Parents' feeling that their involvement should end at providing learning material and paying the necessary fees for children	3.30	.95	Agree
	Cluster mean	3.16	.31	Agree

Table 2 revealed that the respondents agreed to the statements of items 1 to 10 as the personal factors responsible for poor parental involvement in children's education and development. This is for the fact that their respective mean rating is more than the 2.50 criterion mean, with an overall mean of 3.16.

H₀₁: There is no significant difference in the mean ratings of urban and rural parents on the personal factors responsible for poor parental involvement in children's education and development.

Table 3: t-test analysis of the difference in the mean ratings of urban and rural parents

Location	N	Mean	Std. Deviation	df	T	p	Decision
Urban Parents	220	3.18	.30	498	0.945	.287	Not significant
Rural Parents	180	3.13	.31				

Data in Table 3 revealed that there was no significant difference in the mean ratings of urban and rural parents on the personal factors responsible for poor parental involvement in children's education and development: $t(498) = 0.945, p > 0.05$.

Research Question 2: What are the mean ratings of urban and rural parents on the environmental factors responsible for poor parental involvement in children's education and development?

Table 4: Environmental factors responsible for poor parental involvement in children's education and development

S/No	Item Statement	Mean	Std	Decision
11	Parents are not getting the necessary support from government	3.00	.44	Agree
12	Lack of good road network to enable parents coordinate their daily activities with minimal stress	3.60	.58	Agree
13	Incessant power failure	3.40	.66	Agree
14	Poverty level	3.35	.79	Agree
15	High cost of living	3.15	.72	Agree
16	Social insecurity	2.85	.85	Agree
17	Poor state of public schools	3.30	.64	Agree
18	High cost of education especially with Privately owned schools	3.00	.89	Agree
19	Over reliance on digital technology	2.70	.95	Agree
20	Overcrowded social engagement	3.30	.95	Agree

21	Non-functional public transport system	3.00	1.26	Agree
22	Children' school too far from home in an attempt to get good school	3.20	1.07	Agree
23	The teachers not willing to invite parents to discuss children's problems	2.65	1.49	Agree
24	The school not creating opportunity for volunteer service from parents	2.90	.88	Agree
25	The school not being serious with parents' attendance to meetings in school	3.05	.80	Agree
26	The school not willing to accept ideas from parents	3.50	.86	Agree
27	The teachers/caregivers not keeping parents informed about their children's progress in school	3.45	1.07	Agree
28	School not keeping record of parents' activities in school	2.60	.66	Agree
29	School not appreciating parents' involvement	2.85	.69	Agree
30	Poor policy implementation	2.95	.21	Agree
	Cluster mean	3.06	.17	Agree

Table 4 revealed that the respondents agreed to the statements of items 11 to 30 as the environmental factors responsible for poor parental involvement in children's education and development since their respective mean rating is more than the 2.50 criterion mean with an overall mean of 3.06.

H₀₂: There is no significant difference in the mean ratings of urban and rural parents on the environmental factors responsible for poor parental involvement in children's education and development.

Table 5: t-test analysis of the difference in the mean ratings of urban and rural parents

Location	N	Mean	Std. Deviation	df	T	p	Decision
Urban Parents	220	3.08	.11	498	1.066	.084	Not significant
Rural Parents	180	3.02	.22				

Data in Table 5 revealed that there was no significant difference in the mean ratings of urban and rural parents on the environmental factors responsible for poor parental involvement in children's education and development: $t(498) = 1.066$, $p > 0.05$.

Research Question 3: What are the mean ratings of urban and rural parents on the consequences of poor parental involvement in children's education and development?

Table 6: Consequences of poor parental involvement in children's education and development

S/N	Item Statement	Mean	Std	Decision
31	Poor involvement of parents is making children to be antisocial	3.50	.74	Agree
32	Children's achievement in school is going down	3.25	.62	Agree
33	Parental – child relationship is diminishing	3.25	1.04	Agree
34	Children are finding it difficult speaking their mother tongue	3.10	.83	Agree

35	Increasing child abuse and neglect	2.85	1.10	Agree
36	Over exposure of children to digital contents that may not be developmentally appropriate	3.50	.59	Agree
37	Increasing domestic violence	3.00	.94	Agree
38	Increasing cost of living	2.65	1.05	Agree
39	Increasing parental stress level	2.90	.63	Agree
40	Increasing cases of over-schooling	3.45	.74	Agree
41	Increasing teachers' stress level	3.55	.59	Agree
42	Decreasing quality of education	2.90	.99	Agree
43	Increasing social insecurity	3.10	.88	Agree
	Cluster mean	3.15	.22	Agree

Table 6 revealed that the respondents agreed to the statements of items 31 to 43 as the consequences of poor parental involvement in children's education and development. This is for the fact that the items had mean ratings more than 2.50 criterion mean with an overall mean of 3.15.

H₀₃: There is no significant difference in the mean ratings of urban and rural parents on the consequences of poor parental poor involvement in children's education and development.

Table 7: t-test analysis of the difference in the mean ratings of urban and rural parents

Location	N	Mean	Std. Deviation	df	T	P	Decision
Urban Parents	220	3.10	.24	498	-1.172	.079	Not significant
Rural Parents	180	3.21	.18				

Table 7 revealed that there was no significant difference in the mean ratings of urban and rural parents on the consequences of poor parental involvement in children's education and development: $t(498) = -1.172$, $p > 0.05$.

Discussion

The study focused on determining the views of parents (urban and rural dwellers) on the factors responsible for poor parental involvement in children's education and development as well as the consequences of such poor involvement. The results revealed that the respondents (parents) were of the view that personal factors as well as environmental factors are responsible for parents' poor involvement in children's education and development. This is in line with Thomas (2015), who posited that personal factors as well as environmental factors can make parents not to be actively involved in children's all-round development. On the personal factors, parents viewed lack of appropriate information on the learning needs of children as most critical. Other views expressed by parents revolved around the following themes: lack of appropriate knowledge and skills for: (developmental needs, needed areas of involvement, and skill for helping children with homework); poverty (money to provide what children need); time factor; work demands and parents' busy schedule.

These findings may be as a result of the popular saying that no one can give what he has not got. In other words, parents being uninformed, stressed up, too busy and poor would most likely influence their relationships with children. This is because parents are said to be the primary caregiver and socializing agents for young children (Ugwu & Onyekonwu, 2015). Therefore, parents' personal factors, positive or negative affect their involvement in education and development of children. In line with that, Sullivan, Johnson, Owens and Conway (2014), observed indirect relationship between parental stress level and children's school adjustment. McKenry and Price cited in Ngwoke (2019) observed significant relationship between parents' stress level and children's learning outcomes. Corroborating the views on lack of appropriate knowledge and skill by parents, Ancell, Bruns and Chitiyo (2018) showed that parents' poor involvement was not as a result of lack of interest but on other factors within and outside the parents and therefore recommended effective home school collaboration. However, this in contradiction with Mghasse and William (2016) who observed poor state of education and poor learning outcomes and attributed the ugly development majorly to poor attitude of parents towards children's education.

Ancell, Bruns and Chitiyo (2018) observed that schools were not ready to collaborate with parents and went further to recommend that for positive learning outcomes, schools must collaborate effectively with the family. Also, many pre-primary and primary schools in Nigeria are in poor state in terms of quality of instruction, learning readiness on the part of children and learning outcomes. In Nigeria with poor road network, incessant power failure and poor quality public and even private schools (Ngwoke, 2019), coordinating children's school with their own official assignment in addition to home and other social engagement may be too stressful for parents.

It is also evident from the findings of this study based on the views of the respondents, that poor parental involvement in children's education and development has enormous consequences. Lamenting on the poor parental involvement of parents, Ukweze (2016) observed that pre-schoolers are often observed displaying obvious signs of poor school adjustment like poor attachment behaviour, inability to play and work with peers, poor learning skills among others. According to Yamamoto, Holloway and Suzuki (2016), active involvement of parents in children's education and development not only motivates children and increases their academic achievement, but also encourages the teachers/caregivers and contributes to the emotional stability of children. The findings of this study therefore might equip the major stakeholders in the education and development of children (family, school and society) with appropriate information on the factors responsible for and the consequences of poor parental involvement in children's education and development. The school, government and nongovernmental organizations and policy makers, may find the results useful in ensuring that necessary social supports are provided with the hope of leveraging parents from high stress level which may help to increase their involvement in children's education and development.

Conclusion and recommendations

The study revealed that factors responsible for poor parental involvement in children's education and development were both personal and environmental; and while personal factors centred on poor knowledge and skills, environmental factors revolved around poor social support and poor home- school collaboration. Based on the findings of this study, the researchers recommended that: the Universal Basic Education should develop parent education programmes to equip parents with the necessary information on the developmental and learning needs of children as well as how and where parents can get involved in the

education and development of children. Also, Federal Government of Nigeria should ensure that public services are promoted especially in provision of basic social amenities for both urban and rural dwellers. Schools should also be made to promote effective home – school collaboration.

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PARENTAL AGGRAVATION OF LEARNER ABSENTEEISM IN SOUTH AFRICAN PRIMARY SCHOOLS: IMPLICATIONS FOR LEARNER PROGRESSION

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Abstract

Learner absenteeism is a global concern, with scholars identifying the socioeconomic status of communities and parental non-involvement as major causes. This qualitative paper explores the roles played by parents in aggravating learner absenteeism. The study was anchored in two selected South African primary schools and involved eight educators. Individual interviews and focus group discussions were used to gather data. The findings suggest that parents played roles that exacerbated learner absenteeism, which had negative implications for learners' educational experiences. However, during learner promotion from one grade to the next, absenteeism was not considered, resulting in absentee learners being promoted despite their limited academic competencies. The promotion approach focused more on learners' ages and the number of times they might have repeated a grade in each phase. Automatic promotion focuses on maintaining learner dignity and ensuring that all learners complete primary school. Despite its good intentions, the clause exacerbated learners' educational challenges. Absentee learners who missed out on content taught and pertinent developmental opportunities were more likely to struggle in new grades. This struggle makes it important to identify the roles played by parents in exacerbating learner absenteeism and to provide possible solutions to enhance learners' educational experiences and improve their performance.

Keywords: *Absenteeism, performance, parental involvement, progression, school progression policy*

Introduction

Learner absenteeism is an ongoing discourse, nationally and internationally, due to its perceived adverse effects on learner attitudes, performance, and behaviours (Mathewson, 2018). Daraganova, Mullan and Edwards (2014) argue that there is a need for early intervention to avoid an escalation of implications emanating from learner absenteeism that could negatively affect learner achievement. Hence, Gottfried (2010) reports a close relationship between attendance and achievement. Also, Gottfried (2019) argues that, based on the negative repercussions of absenteeism on learners' educational outcomes, there is an urgent need for empirical studies to understand the nature of the phenomenon and to initiate appropriate strategies to deal with it. This thought explains why, in the United Kingdom, psychologists are actively involved in tackling and mitigating the effects of absenteeism at the level of the individual learners and schools (Carroll, 2010).

The effect of absenteeism on learners' educational experiences and performance makes it relevant to explore various contributory factors and to find lasting solutions for the phenomenon. Absentee learners are likely to miss out on both the content taught and meaningful developmental opportunities (London, Sanchez & Castrechini, 2016) that are unavailable in future grades. This phenomenon is common in some South African primary schools due to context-specific challenges (Munje & Maarman, 2016). The South African Department of Basic Education (DBE) expects educators to provide enough support to enable learners to address their subject-specific needs and to cope with the demands of the new

grades (DBE, 2017). However, practical challenges at individual schools contribute to creating a vicious cycle of underperformance. Gottfried (2010) argues that learner absenteeism contributes to poor academic performance across grades, irrespective of support structures available in the classroom. Poor performance is often exacerbated at some South African schools by the number of learners needing individual assistance in each grade, which validates the need to explore the roles parents play in exacerbating learner absenteeism.

Some scholars argue that learner absenteeism is a common phenomenon among low-income learners who, due to lack of basic school needs and social exclusion, may stay away from school, with implications for academic performance (Tesfaye, 2018). Learners who are prone to absenteeism start by exhibiting acts of truancy or regular late coming. The attitudes of some parents towards their children influence this trend (Breda, 2014). The failure of some parents to check whether their children attend school regularly also contributes to truancy (Jensen, 2009). Occasional truancy often translates into habitual absenteeism, which can have negative implications for performance if not managed cautiously (Shafer, 2017). Many individual South African primary schools have the desire to prevent absenteeism. However, the lack of resources and appropriate mechanisms to monitor and deal with truancy and late coming early obstructs the efforts of individual schools (Mboweni, 2014). Absenteeism is, thus, allowed to escalate, with negative repercussions for learner performance. To mitigate the negative implications of learner absenteeism, the education department emphasises the need for corrective and aggressive measures through the establishment of strong partnerships between schools and parents (Nkosi, 2016). This approach aligns with Shafer's (2017) view that parents are relevant partners in the fight against learner absenteeism and finding lasting solutions.

Although socioeconomic challenges emerged as a factor that exacerbates learner absenteeism all over the world (Matthew, 2020; Uleanya & Omoniyi, 2019), the school context exacerbates the phenomenon. In the United States, Jensen (2009) reports that learner behaviour in low socioeconomic communities is often predictable and impacts negatively on school attendance. Due to socioeconomic reasons, parents in communities with low socioeconomic status are less likely to involve themselves in the education of their children (Jensen, 2009; Breda, 2014), leading to negative attitudes towards attending school. In the view of Clark (2017), many parents in communities with low socioeconomic status often engage in work-related activities that keep them away from home for long hours, hence, reducing supervision time. Additionally, some of these parents do not cooperate with school authorities to deal with incidents of learner absenteeism (Mogashoa & Mboweni, 2017). According to Breda (2014), the lack of cooperation increases incidents of learner absenteeism. A decline in parental supervisory roles leads to the probability of learners deviating on their way to school and gallivanting around town with friends (Clark, 2017). The current study, which goes beyond the lack of parental involvement, explores the roles parents play in exacerbating learner absenteeism.

In the South African context, learners' socioeconomic status has been identified as one of the causes of learner absenteeism and, ultimately, underperformance (Kalam et al., 2016; Uleanya & Omoniyi, 2019). However, this generalisation does not consider specific circumstances that are unique to each school context (Coetzee & Venter, 2016). Although over the years the lack of parental involvement in the education of learners has been a concern in South Africa (Mogashoa & Mboweni, 2017; Munje & Mncube, 2018; Segoe & Bisschoff, 2019); its direct contribution to learner absenteeism needs extensive exploration.

Additionally, poverty is a cause of learner absenteeism in communities with low socioeconomic status (Clark, 2017), but the roles played by parents are yet to be adequately explored. Shafer (2017) suggests that understanding the roles played by parents in exacerbating learner absenteeism and dealing with the challenges thereof could change the educational trajectory of many learners across the world, especially in socioeconomically disadvantaged communities. Shafer's (2017) supposition is that fostering partnerships between schools and parents is instrumental in resolving learner absenteeism. According to Shafer (2017), parents have the power to prevent absenteeism and champion the design and establishment of strategies that can potentially translate into long-lasting solutions. Based on such suppositions, we pursue the following questions: (1) what roles do parents play in exacerbating learner absenteeism? and (2) What are the implications of learner absenteeism on progression?

Contextual framework

The pressure on schools to improve learner performance is more challenging in increasingly diverse contexts, thus, widening the gap between policy expectations and the realities in individual schools (Honig, 2006). Hence, LaRocque (1986) argues that policy makers expect educators to willingly comply with policy demands, irrespective of the realities they face, thereby complicating policy implementation processes. Learner performance statistics are failing to meet the expectations of policy makers around the world because the formulation of policies ignores contextual realities. When one looks at learner absenteeism, it is evident the causes are varied and, in some instances, unique, based on context, thus questioning the application of universal approaches when dealing with such a phenomenon. Gottfried (2019) notes that when children miss out on about ten percent of schooling time, there are likely to be damaging repercussions, hence the need for more empirical research in this domain. The need to understand contextual causes of learner absenteeism is urgent and relevant because the magnitude is never the same for every school community because of schools' unique circumstances. In many instances, educators do not have the platform to participate in designing strategies that address challenges related to learner absenteeism. The lack of this platform reiterates the need to understand those peculiarities from the perspective of educators. This view is captured by Yoshida and Van der Walt (2018, p. 39), who argue that "those on the ground tackling the learning more directly do not seem to have sufficient capacity to use their experiences to inform institutional and systemic reforms." This claim validates the need to explore the roles parents play in exacerbating learner absenteeism in a specific school context by engaging educators. This method deviates from the top-down approach to policy implementation, which Yoshida and Van der Walt (2018) consider as mostly ineffective. Viennet and Pont (2017) share Honig's (2006) view that policy implementation is unlikely to be successful without consideration of specific characteristics because context is fundamental to informing the causes of learner performance and strategies that are potentially workable. Honig (2006) argues for the need to consider the circumstances and contexts of individual schools to ensure quality education. Based on these thoughts, this paper explores the roles played by parents in exacerbating learning absenteeism and its implications for progression.

Methodology

The research approach for this study is qualitative, and the design is a case study (Yin, 2018). A qualitative case study approach provides an opportunity to explore the complexities associated with learner absenteeism within a specific school context tapping from the experiences of participants. Eight purposively selected Grade 7 educators from two public primary schools in South Africa responded to individual interviews and engaged in focus

group discussions. These educators had taught at the selected schools for more than five years and understood the dynamics of the schools, including the nature of learner absenteeism. To ensure validity and reliability (Merriam, 2009), data from the interviews and focus group discussions were verified and compared. The data were manually coded and transcribed. A thematic mode of analysis was used (Braun & Clarke, 2012). This method of investigation led to the identification of emerging themes related to the roles played by parents that exacerbated learner absenteeism and its implications on progression. A university in the Western Cape Province and the Western Cape Education Department provided ethical clearance for this study. The research process respected participants' rights to dignity and confidentiality. Consent forms were signed to formalize voluntary participation. For confidentiality purposes, we labelled the schools as A and B. Also, the educators are identified as educators A1, A2, A3, and A4 for school A, and B1, B2, B3, and B4 for school B.

Findings and discussions

The roles played by parents in exacerbating learner absenteeism

Educators revealed that the socio-economic challenges plaguing parents in this community contributed to learner absenteeism. Some parents were unable to provide for their families, due to socio-economic challenges. As a result, some learners, especially boys, took it upon themselves to improve the situations of their families by engaging in work during school time. Educator A3 reported that the presence of wholesalers a few kilometres from the community provided learners with the opportunity to work as grocery carriers to improve the financial situation of their families. Although these learners were able to provide for their families financially, it negatively impacted their ability to attend school regularly, thus exacerbating underperformance. It emerged that the pattern of absenteeism often begins with learners staying away from school irregularly a few days a week, with the probability for some of them to drop out at a later stage (Matage & Begi, 2017; Mboweni, 2014). However, the pattern in school communities such as this is viewed by Sing and Maringe (2020) as a spill-over of the apartheid era that still plagues learners' educational aspirations in disadvantaged communities in South Africa today.

Additionally, some parents kept their children at home intentionally to babysit, perform household chores, and run errands for them, without considering the educational implications. Educator A4 said: "*Some learners do the babysitting when their parents need to do something in the neighbourhood or have a business to attend to in town.*" From this educator's perspective, these decisions by parents had benefits for the family but deprived the affected learners of an opportunity to attend school and to learn. Gottfried (2019) argues that missing out on ten percent of schooling time has negative repercussions on learners' academic experiences. Affected learners are likely to miss out on both the content taught and other developmental opportunities, with implications for their achievement (London et al., 2016). The narrative of the educators was that, when they confronted parents about learner absenteeism, they often gave unfounded excuses. Many of them failed to articulate why they kept the learners away from school. Educator B4 eloquently captured learners' unjust absenteeism and its implications on the teaching and learning process in the following words:

Many of these absences were without cause, and for most of them, the reasons were trivial and unreasonable to be considered as warranting. Learner absenteeism is a big problem because there are no provisions for catch up

classes for those that have been away irrespective of their reasons for not being in school.

In corroboration, educator B1, during a focus group interview, added that learners who regularly ‘bunk’ lessons struggled to cope when they return to school, mainly because there were no provisions to repeat the content already taught. B1 said:

When learners miss out on work done, they do not have any other chance to catch up, and this contributes to how they perform in-class tests and examinations, especially because absenteeism is common.

B1’s explanation was echoed by B3, who said:

When they [learners] stay away for long, they miss out on the work done, and we cannot go back and teach them what they missed out on. If they miss out on something, that is it.

The pattern of learner absenteeism was 2-3 days a week, especially on Mondays and Fridays. The views of these educators align with the findings of Matage and Begi (2017). They investigated learner absenteeism in Kenyan primary schools and found that absenteeism negatively affected learners’ ability to learn and pass. In the views of participants B1 and B2, the inability of parents to check whether their children attended school regularly exacerbated absenteeism.

The absence of extra classes meant that learners who missed days of lessons were accumulating educational challenges. Participant B4 reported that attempts to reduce learner absenteeism through educating parents on the importance of ensuring that learners attend school regularly were futile. In B4’s opinion, they were “*fighting a losing battle*” because the much-needed parental support is non-existent, thereby exacerbating the low levels of learner performance. Participants agreed that the schools were enthusiastic about combatting absenteeism, but a shortage of resources constrained them. Mogashoa and Mboweni (2017) support the views of these educators by emphasising that a lack of resources makes efforts by individual schools to curb absenteeism futile, especially in under-resourced primary schools. However, Shafer (2017) underscores the need for schools to partner with parents to formulate long-lasting solutions to the phenomenon.

Furthermore, work demands kept some parents away from home, thus, giving some learners reasons to stay away from school. While at work, parents assume that their children will eventually leave for school, but that is not always the case. Participant A1 said: “*parents are at work, and they leave their kids alone at home thinking they will come to school.*” Educator A2 added that some of these learners go into the community to spend time with friends, indulging in social ills, including smoking cigarettes and dagga. Non-school-going friends were described by one of the parents as “the big boys” when confronted by an educator. Clark (2017), based on the American context, reports that some learners deviate on their way to school and hang out with friends and wander around town.

The Implications of Learner Absenteeism on Progression

Narratives by educators point to the negative repercussions of absenteeism on learners’ educational experiences and performance. The educators argued that the effects of learner absenteeism were silent during promotion because of the dominance of the age variable in the progression policy. The priority was to realise the Department’s policy prerogatives, which do not allow learners who fail a grade a second time to be retained. The Department encourages the promotion of struggling learners (DBE, 2017). The understanding is that

during promotion struggling learners should be assessed to determine their individual needs, to provide the necessary assistance in the new grade (DBE, 2017). Educator B4 argued that enshrining this clause in the school progression policy meant that absentee learners with limited academic competencies could be promoted unconditionally, based on their age. Although the Department has established regulatory mechanisms, such as “regular attendance,” as a precondition for promotion, the age variable contradicted that clause (DBE, 2017). Educators reported that such inconsistencies opened doors for the promotion of absentee learners who lacked the required academic competencies to cope in the next grade.

It is clear from educators’ commentaries that the availability of multiple options when promoting learners downplays the impact absenteeism has on learner progression. This perception is because promoting learners who are regularly absent from school and lack the required academic competencies exacerbated underperformance, especially in the participating schools, an idea shared by Kabanga and Mulauzi (2020). These learners progressed despite educators being aware of the implications thereof. Educators lacked the authority to overrule the decisions of the DBE, expressed through district officials, who insist on progressing learners with the assumption of receiving extra help in new next grade. LaRocque (1986) aligns with the ideas of Yoshida and Van der Walt (2018) by arguing that challenges related to policy implementation are complicated when educators merely ‘comply’ with the expectations of policy makers. The need for compliance explains why educators said they only followed district officials’ orders, even though they knew the dangers of promoting learners who were not ready for the next grade.

Educator A1 said that district officials focused more on how many learners progressed while neglecting the implications thereof. The educator said:

They look at the schedules to see how many learners have been promoted, not trying to know the structures that are in place to help the learners as they want them to be promoted needing assistance.

In the view of Educator A1, the misplaced focus of the Department was on the number of learners promoted, of whom many need assistance, without considering their attendance records and the machineries in place to assist them in the next grade. Educators were unanimous that absentee learners should be allowed to repeat, to acquire more knowledge, and reduce impending challenges in the next grade.

Educator B4 further explained the dilemma they faced due to contradictions between policy and practice in the domain of progression:

Although when learners absent and fail, they ought to repeat, the law has been modified to say that if a child is not coming to school regularly and happens to fail, but [because the learner] is over age; the cohort policy will not be applicable.

Educator B4 again elaborated on the policy’s inconsistency regarding its criteria for promotion, especially regarding absentee learners (DBE, 2017):

If this was the case, attendance at this stage can put some brakes on the cohort policy. But this does not make a big difference in the domain of promoting learners [who] do not attend classes regularly, but are pushed to the next

grade, because of the age cohort, or because they already repeated the grade or phase. It is very confusing sometimes.

The argument of this participant corresponds with the idea of Gottfried (2011) that absentee learners miss out on both the content taught and other developmental opportunities that may be lacking in the new grades. Educators were concerned about proper practical mechanisms that were not in place to deal with individual learner challenges in new grades. The policy indicates that learners who progress with deficiencies should receive assistance in the new grades, though without specifying the details of that support in individual school contexts. Hence, Honig (2006) emphasises that it is fundamental to consider the circumstances and contexts of individual schools when formulating educational policies to ensure quality education.

Educators argued that the failure to consider the adverse effects of promoting absentee learners exacerbates underperformance. Educator A3 argued that the promotion of absentee learners who lacked the necessary academic competencies contributed to voluntary dropout as some learners could not cope with the pressures of the new grade. The absence of extra assistance specified in learners' progression records exacerbates the phenomenon. In some instances, many learners who need individual attention frustrates teachers' efforts.

Conclusions

Findings show that parents exacerbate learner absenteeism in the selected South African primary schools. The effects of learner absenteeism on the teaching and learning process were silent during the promotion of learners. The school progression policy prioritises learners' ages and the number of times they have repeated a grade in a phase, thereby negating the negative implications of absenteeism on knowledge acquisition and missing out on other developmental opportunities. This article provides a discursive and research space on the roles played by parents in exacerbating learner absenteeism in varied school contexts in South Africa. Data emerging from such studies have the potential to act as a catalyst for discourses aimed at achieving lasting solutions for learner absenteeism in communities that have low socioeconomic status. Such efforts have the potential to enhance learning opportunities for affected learners and help them to acquire the expected educational experiences.

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TEACHERS' PERCEPTION ABOUT THE INTEGRATION OF GEOGEBRA IN THE TEACHING OF MATHEMATICS IN SOUTH AFRICAN HIGH SCHOOLS

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Abstract

Integration of GeoGebra is one of the proposed intervention strategies in addressing the challenges in mathematics education. This qualitative study explores teachers' perceptions on their exposure to using GeoGebra in the teaching of mathematics in South African high schools. Using interpretivism, the researchers listened to the views, opinions and understanding of teachers in the integration of GeoGebra during the semi-structured interviews and non-participant observation of the four purposively selected teachers from four high schools in Bojanala district in North West province in South Africa. The interviews were transcribed, coded and designated into worthwhile themes. The study appreciates that teachers are crucial in the actual integration of any technology including GeoGebra and hence focuses on exploring their perceptions in the usage of GeoGebra. The key finding was that there is a need to strengthen professional development of teachers in the integration of GeoGebra. The study concludes that teachers are enthusiastic in using GeoGebra and other technological tools. Teachers believed that GeoGebra was a fun mathematics software to use and valuable in conceptualisation and visualisation of mathematics concepts.

Keywords: Information and Communication Technology, Information and Communication Technology Integration, GeoGebra Software

Introduction

In order to master Mathematics, it is pivotal to develop and master the skill of understanding and applying problem-solving procedures. These procedures include the manipulation of equations and their logical application and an attentive approach to ensure the accuracy of solutions (Iji, Abah, & Uka, 2013). The use of mathematics software has the ability to enforce such procedures (Zilinskiene, 2014). Moreover, most learners perceive mathematics as abstract and difficult to understand. The increase in concern over mathematics performance in general and glaringly poor performance in high school call for change in how mathematics is being taught. There is concern is elucidated in that only 10% of South African high school graduates are able to pursue mathematics related courses at tertiary institutions (Spaull, 2013). Moreover, from the 10%, only 6% of those learners manage to get a grade of 60% and above.

However, poor mathematics performance is not only a uniquely South African phenomenon. There are various interventional strategies that have been used by countries who have better mathematics performance, internationally to address this problem. (Leendertz, Blignaut, Blignaut, Els & Ellis, 2013) propose that the integration of technology through the use of the correct ICT software is known to create and enhance an effective teaching and learning environment. It is worth noting that the United States of America, the United Kingdom, Denmark, Hungary and Australia are some of the countries that advocate for the use of ICT software in the teaching of mathematics. They believe that mathematics software is a means of improving the quality of the mathematics output as well as increasing the interest in mathematics and other subjects that relate to it (Jankvist & Misfeldt, 2015; Lavicza, 2007).

Mathematics software programs are further known to bring about advantages that allow teachers to focus on specific mathematics topics, bring about dynamic movement, sound and graphics to enhance learning, and make a contribution to problem-solving tasks, practising number skills and exploring patterns and relationships (Sivakova, Kochoska, Ristevska, & Gramatkovski, 2017). These aspects of mathematics assist learners with conceptualising the abstract ideas in mathematics and, thus, enhance their learning. South Africa is also no exception as it opened various avenues to strengthen mathematics teaching and learning through the integration technology and specifically mathematics software. GeoGebra is one of the chosen mathematics software that have been used in the teaching of high school mathematics. Mushipe and Ogbonnaya (2019) postulate that the impact of integration of GeoGebra was proved to be effective in the teaching of mathematics in the South African curriculum.

However, teachers are pivotal in the actual integration of any recommended technology. According to (Abboud-Blanchard, 2010), mathematics teachers find it difficult to integrate technology in their teaching of mathematics. (Mdlongwa, 2012) further attests that many South African teachers in both rural and urban schools are mystified by ICT and have only basic skills in the use of ICT. Furthermore, teachers are noted to experience pedagogical challenges in designing, ordering and organising class activities and integrating various mathematics software during teaching and learning (Leendertz et al., 2013). Hence, this article seeks to answer the question, what are the teachers' perception about the integration of geogebra in the teaching of mathematics in south african high schools.

ICT integration in teaching and learning of mathematics in South Africa

In South Africa, the integration of ICT has been in process since 1980 (Mdlongwa, 2012). The initial integration was focused more on computers as the ICT device, and this later grew into the integration of tablets and other devices. The Department of Education (DoE, 2004) further introduced the e-Education policy, which suggested the inclusion of ICT into the curriculum by 2013.

The integration of ICT tools has been supported by sponsors focusing on various aspects of integrating ICT in teaching and learning. The sponsors include Mustek- e-Learning which focused in the usage of technology in schools and in the society as a whole (Van Wyk, 2014). The Khanya, School Net project which is focused in ensuring that technology is implemented in schools and offer support to teachers in the usage of technology. In conjunction with all these initiatives, DBE has also introduced the Guidelines for Teacher Training and Professional Development in ICT (2007) for teachers on how ICT may be integrated in the teaching and learning environment (Hindle, 2007). This guideline is supposed to offer structure and regulate the implementation of the training of teachers in the usage of technology in their classrooms.

Background of integration of GeoGebra in high School mathematics

GeoGebra is widely used in South African high schools with most research showing its use in KwaZulu-Natal, Limpopo, Gauteng and Limpopo (Bayaga, Mthethwa, Bosse, & Williams, 2019; Chimuka, 2017). Furthermore (Stols & Kriek, 2011) are of the opinion that the integration of mathematics software depends on teachers' knowledge and belief about the software of choice. Hence, the study focuses on the teachers' perception in the integration of GeoGebra in the teaching of mathematics. As participants, the study uses teachers from the North-West Province who have received training in the integration of GeoGebra software in the teaching of mathematics.

GeoGebra is a free mathematics software program that can be used for teaching statistics and probability, geometry and functions, and can be applied at different school levels. It has received numerous awards since 2002 (Hohenwarter & Lavicza, 2009; Majerek, 2014; Zilinskiene, 2014). The name “GeoGebra” is a combination of “geometry” and “algebra”. This software tool is known to be innovative, open-code mathematics software (GNU General Public License) that can be downloaded free of charge from the www.GeoGebra.org website. GeoGebra works on a wide spectrum of operating system platforms that have had the Java virtual machine installed (Dikovic, 2009).

The literature review is focused on the teachers’ views and opinions in the integration of GeoGebra software in the teaching of mathematics in South African schools. GeoGebra is one of the various mathematics software and it works in conjunction with other mathematics software and ICT tools. It is therefore important to understand teachers’ perceptions in the context of ICT tools and software tools.

Integration of ICT software in mathematics teaching and learning

This section encapsulates the integration of various types of mathematics software, including GeoGebra software, in various countries. Literature is reviewed on mathematics software and GeoGebra in particular that has been integrated into teaching mathematics at various levels in high schools in several countries. Most literature reveals the positive impact of using GeoGebra software in teaching mathematics (Curri, 2011; Kafyulilo & Kisalama, 2012; Kannan, Harma, & Abdullah, 2012). Hence, this study seeks to explore teachers’ perceptions in their integration of GeoGebra in the teaching of mathematics in South African high schools. According to Preiner (2008), the integration of technology into teaching and learning in mathematics may be classified into two forms, namely virtual manipulatives and mathematics software tools. Virtual manipulatives comprise a specific learning environment, which requires minimal computer knowledge. In teaching mathematics through virtual manipulatives, learners explore mathematics ideas with limited computer skills or knowledge of mathematics software.

The mathematics software tools are selected for educational purposes and can be used in different mathematics topics such as algebra, geometry, statistics and trigonometry. Mathematics software tools allow flexibility and permit both teachers and learners to explore mathematics topics and to gain conceptual understanding. Hohenwarter et al. (2008) define GeoGebra as a dynamic mathematics software tool for schools that can be used to learn algebra, geometry, statistics and calculus from primary school to university level. GeoGebra uses various mathematical built-in systems, namely GeoGebra CAS, GeoGebra Spreadsheet, GeoGebra Mobile and GeoGebra 3D (Kovacs, 2014).

Mathematics covers complex topics and therefore it is important that teachers integrate technology in their teaching. The integration of technology will allow a diverse teaching approach and an interactive mathematics lesson. However, this will be made possible if teachers evaluate “technology-driven instruction strategies and activities such as mathematics software that will enhance students’ attitude, conceptual skills, and procedural skills” (Mendezabal & Tindowen, 2018, p. 393) in mathematics courses.

According to Zilinskiene (2014), there are four aspects of any mathematical software, including GeoGebra, that can be used as an effective part of mathematics teaching and learning. The first is a multiple display option, which is the availability of various ways of

displaying mathematics content, for example displaying a quadratic equation $x^2 - 1$ into graph form. A teacher may further display what happens when the equation changes to $x^2 + 1$. Demonstration and visualisation are important in understanding mathematics concepts during the process of problem solving and learning. The second is experimental work, which describes the possibility of learners using experimentation in order to gain an understanding of the taught mathematics concepts. Thirdly, the elementarisation of mathematics methods, for example mathematics software, will have tools that learners can use to draw or design mathematics concepts such as different types of triangles with their properties. The last aspect is connectivity, which is described as opening up new opportunities for shared knowledge construction and learner autonomy over their mathematics work.

All these aspects of mathematics software are important in guiding teachers in their lesson planning. As (Almadhour, 2012) pointed out, teachers are important in the effective integration of ICT tools in teaching and learning. This view is supported by (Hismanoglu 2012, p. 183), saying that “the prospective teachers having five ICT-related courses displayed better attitudes in comparison to those not completing this training period”. A well-executed lesson needs proper planning by a teacher who has an understanding of various aspects of technology, which make learning mathematics understandable and interesting. Various countries advocate for the integration of specific mathematics software in their teaching, and some endorse mathematics software in their policy.

In Zilinskiene’s (2014) study of the integration of GeoGebra in mathematics education, suggestions were made on integrating GeoGebra software into specific mathematics topics covered in the Lithuanian curriculum. Table 1 below illustrates the GeoGebra perspective in the Lithuanian curriculum and how GeoGebra software has been integrated in the mathematics topics.

Table 1: Application of GeoGebra software in Lithuanian education (Zilinskiene, 2014)

Mathematics content	GeoGebra perspective	GeoGebra application example
Numbers and calculations Algebraic measurements	Algebra and graphics	To explore how to increase or decrease numbers by units. To solve simple equations, inequalities, etc.
Geometry, numbers and calculations Measurements	Geometry, numbers and calculations Measurements	To plan and understand orientation in a plane by analysing main concepts to the right, to the left, above, etc. To focus on the appropriate concept (triangle, rectangle, square, etc.)
Tables and graphics	Numbers and calculations Algebra measurements Statistics	To explore data, to influence data by changing them and to represent data by diagrams.

Furthermore, South African, Korean and Nigerian teachers promote the integration of GeoGebra software to enhance the teaching of geometry and algebra in their mathematics lessons and enhance their visualisation skills (Meng, 2013; Mosia, 2016; Mukhari, 2016).

Integration of GeoGebra software in teaching mathematics in high school

GeoGebra originated in the master's thesis project of Markus Hohenwarter at the University of Salzburg in 2002 (Hohenwarter & Preiner, 2007; Hohenwarter et al., 2008). This software combined features of older software programs, such as Maple, Derive, Cabri and Geometer's Sketchpad (Saha, Ayub, & Tarmizi, 2010). GeoGebra is a free and user-friendly program that connects geometry and algebra (White, 2012). According to (Majerek, 2014) GeoGebra as an interactive geometry, algebra, statistics and calculus application that is intended for learning and teaching mathematics from the primary level of education to university level. GeoGebra allows for the creation of interactive web pages that are used for the demonstration and experimentation of various mathematics concepts (Hohenwarter & Lavicza, 2011). GeoGebra is available on multiple platforms, with desktop applications for Windows, OS, Linux and Mac. It also has tablet applications for Android, Apple and Windows (Majerek, 2014).

The Ministry of Education in Australia has made GeoGebra software freely available at schools and university since 2006. It has also been adopted by Florida Atlantic University in America for their mathematics project to enhance the teaching and learning of mathematics (Hohenwarter & Preiner, 2007). According to (Preiner, 2008), the integration of technology into teaching and learning in mathematics may be classified into two forms, namely virtual manipulatives and mathematics software tools. Virtual manipulatives comprise a specific learning environment, which requires minimal computer knowledge. In teaching mathematics through virtual manipulatives, learners explore mathematics ideas with limited computer skills or knowledge of mathematics software.

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- **GeoGebra CAS**

GeoGebra CAS is a CAS that is important for symbolic computation of algebraic functions. It also allows learners to work with fractions, equations and formulas.

- **GeoGebra Spreadsheet**

GeoGebra Spreadsheet includes images and buttons to create diagrams representing line graphs or bar charts by choosing various available options. The user may import files from external sources or local files.

In a study conducted by (Chimuka, 2017) on the integration of GeoGebra software in teaching mathematics in high school, it was found that “the integration of information technology (IT), GeoGebra in particular, into teaching and learning of secondary school mathematics can serve as a scaffold on which changes and developments in curriculum can be better managed”. Various countries have endorsed the integration of GeoGebra in the teaching of mathematics. In Slovakia, a study presented several possibilities of how GeoGebra might be integrated into education. GeoGebra is recommended for solving

geometry tasks in the new Slovak curriculum for secondary schools (Gunčaga, Majherova & Jancek, 2012).

Research methodology

This paper is part of a larger study that qualitatively explored how teachers integrate GeoGebra in the teaching of mathematics in South African high schools. This particular study used interpretivism as paradigm to explore how teachers integrate GeoGebra in their teaching of mathematics. Interpretivism is an approach where individuals seek to understand their world by providing participants with opportunities to share their experiences, views and opinions (Thanh & Thanh, 2015). The qualitative approach has been particularly suitable for this study, as we unveiled the meaning of a phenomenon by using the views, perceptions and experiences of the participants (cf. Maree, 2012; McMillan & Schumacher, 2010). According to (Okeke & Van Wyk, 2016), qualitative research methods are concerned with understanding human thoughts and behaviour with emphasis on the meaning they attach to their actions. We therefore considered in detail the cases of four teachers, each as a separate case, and made an intra-case analysis. (Punch, 2011) maintains that the case study is an empirical research method that investigates the phenomenon within its real-life setting and relies on multiple sources of evidence. We, therefore, considered the stories of the four participating teachers as separate entities and cross-examined their stories in search of commonalities and differences.

In order to collect the necessary data, the researchers used semi-structured interviews and class observations, we managed to facilitate a subjective relationship with the participants whereby we sought to understand the integration of GeoGebra from their perspective. Four teachers from four different high schools in the Bojanala district, North-West Province, were selected using purposive sampling. The data collected was transcribed, coded and categorised into meaningful themes that emanated from the data. The use of both semi-structured interviews and observations helped to guarantee the issues around credibility and trustworthiness of the data. All the participants signed the consent forms to illustrate their willingness to participate in the study.

Research Findings

This section is presented in themes that emanated from the collected data and through the voices of the four interviewed and observed teachers. The names of the teachers as used in the study are as follows: Magwe, Sebaya, Golenyane and Maziya

Magwe is a high school teacher with six years' experience in teaching mathematics, physical science and technology from grades 8 to 12. He holds a BSc in Computer Science and Electronics as well as Postgraduate Diploma in education, the PGCE. He has been using other ICT tools and been using GeoGebra for 18 months.

Sebaya is a teacher with six years' experience in teaching mathematics, natural science and technology from grade 8 to 13 in a wide variety of provinces in South Africa. He holds a BEd. Honours degree, PGCE in Natural Science and Mathematics and B. Comm Statistics degree. He has been using other ICT tools and been using GeoGebra for over a year.

Golenyane is a teacher with nine years' experience in teaching mathematics, natural science and computer science. He holds BSc Computer science and PGCE qualification. He has been using GeoGebra and other ICT software tools for six years.

Maziya is a teacher with five years' experience in teaching mathematics and physical science from grades 8, 10 and 12. He holds a BEd in Science and Mathematics, BEd (Hons) Physical Science and currently working on his MEd. He has been using other ICT tools and been using GeoGebra for over a year.

Teachers' perspectives on GeoGebra in the teaching of mathematics in South African curriculum

The study is based on the integration of GeoGebra within A South African high school context. The South African high school mathematics curriculum is outlined in the Curriculum and Assessment Policy Statement (CAPS). The CAPS document (DBE, 2011) outlines the mathematics content areas that need to be taught in South African high schools. It declares that the mathematics content should be taught in a manner that develops the learners' mathematical reasoning and creative and reasoning skills (DBE, 2011). On the other hand, the study is focused on the teachers' perceptions of the integration of GeoGebra in the teaching of mathematics in South African high schools. Hence, it was important to establish from the participants what they thought of the link between the mathematics curriculum, according to the CAPS document, and what GeoGebra software could do.

Participants indicated that they perceived GeoGebra as a valuable tool in teaching high school mathematics in the South African curriculum. They further indicated that they found GeoGebra to be valuable in constructing an exciting learning atmosphere, enhance conceptual understanding. Sebaya indicated that learners got excited at the sight of technological tools.

GeoGebra has the ability to create an interesting learning atmosphere ... So they were like 'oh you brought your laptop' like ... they just like it when you are using technology...

Magwe also reiterated that GeoGebra encourages learners to be enthusiastic about learning and thereby encouraged independent learning. He noted that learners would be eager to share their learning experiences whenever, they have tried to work on some mathematics problem independently. This further displayed a sense of enthusiasm into learning.

They would come to you and say, 'are you aware that with that software you gave us yesterday-?' that means when they got home they didn't go anywhere, they just stayed and they were interested in learning more.

Maziya also share the similar sentiments indicating that learners would be thrilled with just the mentioning that the mathematics lesson will be conducted in a mathematics laboratory.

..... Learners love to work with technology. There will be so excited when you say, today we are working at the lab. I would give them maybe a classwork to on. Let's say we did a maths lesson in class. Yah... next time we will go to the lab and do the maths we did in class.

From the above quotation, it was evident that learners looked forward to a lesson that incorporates technology and GeoGebra was contributing in creating an interactive and exciting learning atmosphere. According to (Bower, Hedberg & Kuswara, 2010) further hypothesize that the introduction of ICT in a learning environment encourages an active engagement between learners and their teachers and amongst learners themselves.

Participants further indicated that GeoGebra was valuable because it helped learners visualise the abstract aspect of mathematics while it also helped with conceptual understanding. Magwe made an example referring to teaching of the abstract of aspect of Geometry when he wants learners to understand that there is no angle that is 180 degrees because 180 degrees lies on a straight line.

...when you can relate it stays in their mind that I cannot have an angle that is 180 degrees because it's just a line. When the lines have been connected and triangles drawn, learners see, this is the angle and this is the length....

Golenyane also added that learners often struggle with understanding of graphs. They may confuse the aspect of the gradient when the graph is increasing or decreasing. He made an example of how GeoGebra helps learners to visualise this aspect algebra in learning Functions succinctly:

Then for also when we are comparing the graphs why are we saying this graph is increasing, why are we saying this graph is decreasing. In GeoGebra, you can draw these graphs, then show learners that when the gradient is like this then there is increasing graph and when the gradient is like this, then there is decreasing graph.

From the above quotations, it was evident that teachers perceived GeoGebra to be valuable as a tool that made the abstract concepts in mathematics relatable. (Azizul & Din, 2018) concurs that GeoGebra enhances the visualisation and understanding of mathematics concepts for both the teacher and the learner.

GeoGebra was further found valuable by participants in assisting them with their time management. Participants further indicated that they found GeoGebra to be valuable in teaching of mathematics because it allowed them to draw accurate diagrams without spending too much of their teaching time. Magwe appreciated GeoGebra because of the feature that he was able to get accurate angle sizes. It is difficult to draw an accurate angle size on the board and the inaccurate angle sizes may distort the information. This could ultimately lead to misconceptions in mathematics concepts. Magwe, praised GeoGebra, stating that:

I have once tried the Microsoft. But it always limits you; the triangles wouldn't be that perfect sometimes because they don't give you your 90 degrees angels like GeoGebra

Magwe further added an example when GeoGebra illustrated and saves time in teaching of Functions. He mentioned that he would just insert a few instructions on GeoGebra and the accurate Cartesian plane will be available for learners and then learning can proceed promptly.

... Let's say, I'm teaching graphs....., instead of re-drawing on the board you just click and open that page, open and explain whatever you want to explain...Because previously you had to draw it on the board, if it's a complex model you take plus or minus 5 minutes drawing it and learners would be making noise or something. But now you just jump from 1 diagram to the next, it's as easy as that. But once you are used to it it's very convenient

During the class observation, Sebaya also illustrated accurate drawing where learners had to establish the missing size of the interior angle in a triangle when two interior angle are given (Figure 1), below. Learners did not have to imagine the angle size but could appreciate the visualisation aspect of using GeoGebra. (Curri, 2012) concurs that ICT activities supported by visualisation can expand the learning of mathematics.

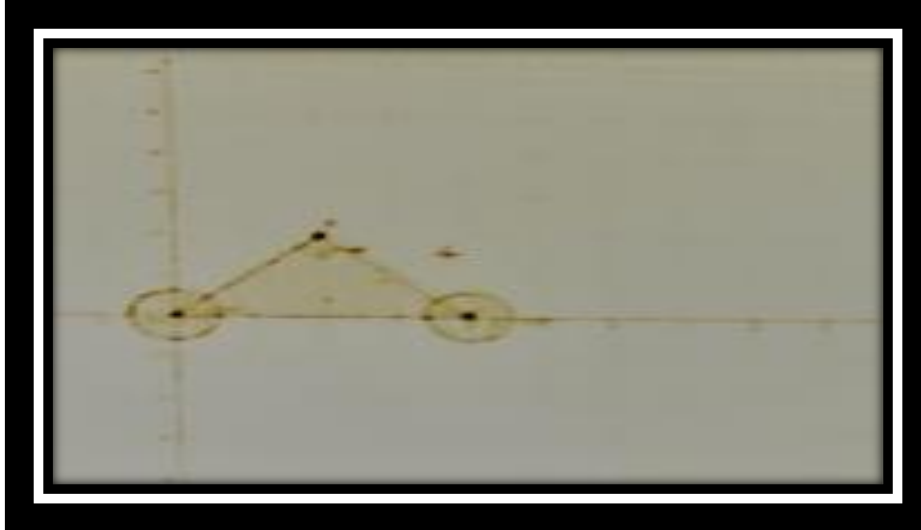


Figure 1: An illustration of visualisation of angle sizes

From the Class observation, Golenyane also assisted learners to conceptually understand the parabola graphs when they are either positive or negative (Figure 2). (Armah et al, 2012) attests that the benefits of using mathematics software is that technology allows diversion from traditional teaching and encourages conceptual understanding of mathematics concepts.

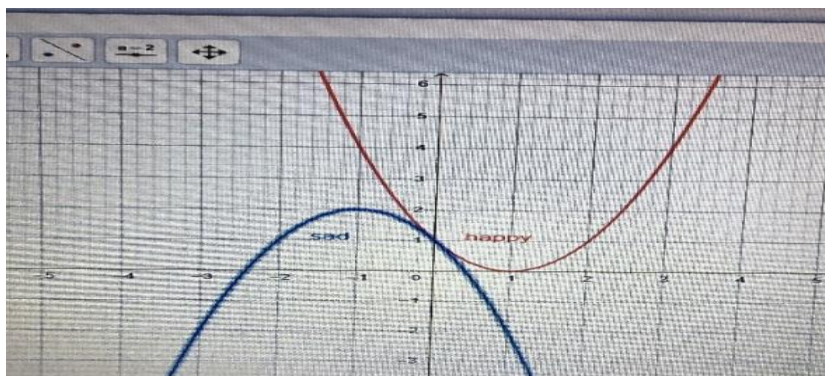


Figure 2: Illustration of parabola graphs to assist learners with conceptual understanding

Participants further appreciated the value of GeoGebra that it was relevant in teaching mathematics within a South African curriculum. Most participants used GeoGebra in teaching Function and Geometry. Magwe indicated that he used GeoGebra in teaching graphs, trigonometry and Geometry, which are topics also available in the CAPS document. Moreover, the South African curriculum outlines the weighting of content areas, where Functions and Geometry weigh highly as 35% and 30% respectively (DoE, 2011).

The integration of GeoGebra through its measure software application in teaching of Euclidean Geometry (Choong & Hale, 2017). Therefore, participants also found GeoGebra to be relevant in teaching Geometry. (Stols, 2012) also hold the view that GeoGebra has

excellent illustrative features when integrating GeoGebra to teach Geometry. Magwe attested that GeoGebra was relevant in mathematics in a high South African context, stating that:

Yeah because most of the topics that are there you can use GeoGebra. For example, the graphs, trigonometry and Geometry are there on the CAPS document and you can also teach them using GeoGebra... Most of the time like in Algebra we draw 2 different graphs. For instance, say quadratic graphs and linear graphs (Magwe).

Sebaya also concurred that GeoGebra was relevant in teaching mathematics in the South African curriculum. He mentioned that:

... In CAPS, you have Functions, Geometry You have Trig. All these topics one can easily teach them using GeoGebra.

Golenyane also added that he used GeoGebra for teaching Geometry topics to his grades 10, 11 and 12 learners.

Yah, I use GeoGebra a lot, especially in grade 10, 11 and 12 classes. In fact, when I am using GeoGebra most of the time, I am using it for the chapters that are dealing with objects. Yes, like chapters in Geometry (Golenyane).

Sebaya also reiterated the same sentiments that he also found GeoGebra to be valuable in teaching of Geometry. He would use to teach properties of triangles. He made reference to the names of triangles and the fact the total sum of interior angles of a triangle equals to 180 degrees.

Okay, maybe I am teaching properties of triangles. I would ask learners what they know about an Isosceles triangle. Then, maybe draw it. And tell them. You see the two opposite sides are equal and the angles opposite the two equal sides are equal... And, then you ask them, what is the sum of this triangle, the sum of this triangle 180, this one? What can we conclude about the sum angles of this, that is easy for them to conclude so that they see what is happening?

Mr Golenyane echoed the similar sentiments about the value of GeoGebra,

In fact, when I am using GeoGebra most of the time I am using it for the chapters that we are dealing with objects. For instance, chapters like Geometry where we are going to be dealing with theorems, for instance like angle at the center is twice to the angle at the circumference.

Maziya also hailed the value of GeoGebra in illustrating an abstract of Geometry to helping learners understand the Geometric principle of what happens to the angles when they are placed within the circle and said:

I mainly use it in-, including Geometry and for Mathematics.

Participants further indicated that GeoGebra is good for illustration in the teaching of functions. (Elipane, 2017) states that GeoGebra has features that make it easy to find points of functions such as the roots of the function, domain and range and identification of the gradient. Magwe elaborated on how he used GeoGebra to teach functions and demonstrated limited knowledge of how Functions may be taught through GeoGebra.

For instance, say quadratic graphs and Linear graphs. Then we'll ask learners to interpret the graphs. The points where the graphs are equal. Yes, where the function is increasing or decreasing.

Sebaya shared the similar sentiments GeoGebra was good in the teaching of Functions and appreciating its features:

Okay, let's say we are dealing with two graphs. Because most of the time we combine the two graphs, we combine the two. So, most of the time when learners are given two graphs as I have said before now we can interpret, because it's easier for learners to draw the graph using GeoGebra.

Magwe further reiterated that GeoGebra is good in teaching linear functions and it helped learners understand various aspect of the graphs.

...You show how for instance when you talk about the Parabola you show them when it goes like this or why are we saying A is less that the gradient of the graph. We can say-, you can show them if it becomes narrow it does what, if it becomes wide how it affects the graph.

Challenges in the integration of GeoGebra software

Ndlovu and Lawrence (2012) contend that there a variety of challenges faced by teachers in the integration of technology in their teaching. It was, therefore, intriguing to establish any possible challenges that participants encountered in their integration of GeoGebra. They believed that GeoGebra was relevant and overall good in teaching high School mathematics. However, they also felt that their knowledge of using GeoGebra was limited. Maziya attested that found value in GeoGebra but he had a challenge of using it for teaching Trigonometric graphs.

Uh to show them the angles inside the circle attended by the cords and the arc, only in circles because there is a part, which is too difficult for me to-, especially in trigonometric graphs. The reason is because it's using a lot of polar equations like these pies of 180 degrees.

Sebaya shared the similar sentiments, indicating that he still has a lot to learn about GeoGebra. He indicated that he felt he needs more skills in drawing mathematical diagrams and looked forward to acquiring such a skill.

GeoGebra, I like it I still have a lot to learn about it though. -, but I don't I know less than 50% of what I can do with GeoGebra. If I can see myself being able to draw my own diagrams, any diagram then I would say that I am satisfied

Magwe further added that GeoGebra needed a lot of preparation time for a mathematics lesson. In situations where he planned to use GeoGebra in a lesson, he needed to spend time doing research and also thinking about how he would use GeoGebra.

You know...if I am going to use GeoGebra in class, say the next day. I spend a lot of time preparing. I wish it did not take so much time (Magwe).

The above quotations with reference to challenges with GeoGebra, showed that the participants had challenges with the integration of GeoGebra into their mathematics lessons. The challenges included preparation time, lack of broader knowledge in using GeoGebra features and the learners' lack of computers. This study established that in as much as the raised challenges by the teachers are valid, teachers needed continued support and that they themselves needed to be more committed and willing to put in the effort of learning the GeoGebra features that could enhance their teaching experience.

Conclusion

The overall perception of participants about GeoGebra gave an indication that teachers found value in GeoGebra software in terms of it creating an exciting learning atmosphere and they appreciate its relevance in the South African curriculum. Furthermore, teachers perceived GeoGebra to be a valuable tool because it could help learners understand Functions, Geometry and some aspects of Trigonometry. In the same breath, the examples which teacher participants gave indicated that they lacked depth and breadth of understanding the extent to which GeoGebra could be used in the teaching of the same mathematics topics. It was however, impressive that they recognized the value because it meant that with adequate training and exposure they could use GeoGebra to its full capacity to the full benefit of learners

In terms of the assessment of integration of technology teaching and learning, the teachers demonstrated the basic understanding of what GeoGebra can do but needed more in-depth knowledge of the software as a technological tool in teaching such concepts to the full advantage of GeoGebra. And from this study, I concur with (Koehler, Mishra & Yahya, 2007) that there is a knowledge gap regarding GeoGebra as being the aspect of technology. It was therefore clear from the participants that they endorsed GeoGebra in teaching Functions and Geometry. They endorsed the illustrative power of GeoGebra that brought conceptual understanding of some of the abstract Geometry concepts. But GeoGebra has more to offer and therefore further training will be beneficial to both teachers and learners in enhancing integration of ICT into teaching and learning mathematics in South African high schools.

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PRINCIPALS' PERSPECTIVES ABOUT LEADING SCHOOLS IN RURAL CONTEXT

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Abstract

Research about school leadership in rural contexts is dominated by deficit paradigms without acknowledging the availability of resources and the potential of school leaders in the said context. The purpose of this paper is to explore the principals' perspectives about leading schools in rural context. The voices of those who live and lead schools in rural context have the potential to add to the existing body of knowledge, inform policy and practice about education leadership in general and educational leadership in rural context specifically. Data was generated through interviews with four primary school principals in Lesotho. The schools were purposely selected on the basis that they are located in a rural context. The four principals that were selected as participants had more than five years of experience as principals. The findings revealed that schools in the rural context of Lesotho are faced with myriad socio-economic challenges. These challenges include, but not limited to, poverty, shortage of resources, and extreme cold weather especially during the winter season when heavy snowfalls in some days. Despite these challenges, the findings show that the participants were able to mitigate various challenges and successfully led the schools. Instead of mourning about challenges, the participants adopted flexible context-based approaches to harness available resources within and beyond the communities for the betterment of the schools. I consequently argue that successful leadership of schools in rural context requires principals who recognise not only the challenges but also the opportunities that exist in such a context.

Keywords: *leadership, opportunities, resources, rurality*

Introduction

Literature is clear that leadership influences the success or failure of the schools (Bush, Bell & Middlewood, 2010; Coles & Southworth, 2003). While researchers in education leadership had tended to generalise the impact of leadership in all contexts, new studies (see Halinger, 2018) reposition the debates about education leadership by pointing out that education leadership should be understood within a given context. Research about education leadership in rural context has largely been done in developed countries and predominantly informed by deficit paradigms. Yet some resources and assets can be harnessed for improvement in schools in rural contexts (Moletsane, 2012). Cognisant that there are some challenges in rural contexts, this paper will also dwell on the opportunities that the school principals explore in pursuit of school goals. In doing so, I will argue that the perspectives of those who live, lead, and manage schools in rural context matters. The primary questions guiding this paper is: What are the Principals' perspectives about leading schools in rural context? The secondary research questions are as follows: What are challenges of leading schools in rural context? What are the opportunities of leading schools in rural context?

This paper seeks to contribute to the existing body of knowledge regarding school leadership in rural context of Lesotho from the perspectives of the school principals. This knowledge may inform schools about leadership practices in similar context. The policy makers are also likely to benefit from the findings in this paper since policies are adopted or amended to promote best practices. The following section reviews relevant literature.

Literature Review

Principals in different contexts encounter leadership challenges, however, literature indicates that these challenges are more intensified in rural context (du Plessis, 2017; Mendiola, Bynum & Westbrook, 2019). In a systematic review of literature about leading rural schools, Mendiola et al (2019) identified challenges that rural school principals face which include: heavy management demands and teaching workload. The rural schools were also found to be isolated and located far away from the cities. They had limited resources and located in communities that are generally poor. Writing from a South African context, Makhasane, Simamane & Chikoko, (2018) argue that challenges facing rural schools have operational implications. Poverty, for instance, implies that parents would have limited or no financial resources to support the schools that their children attend.

The roles of the principals in the twenty-first century have changed considerably. To this effect, principals are expected to possess leadership skills and knowledge that they can apply to address the demands of the twenty-first century. They have to perform multiple roles (Adams & Muthiah, 2020). In response to the leadership demands in the twenty-first century, specialised training is a prerequisite for appointment to the position of the principal in countries such as the United States of America, New Zealand, Finland, the United Kingdom, and Denmark (Thompson, 2017). Yet in other countries including Lesotho, any qualified teacher with experience can be appointed as a principal. The multiple roles that principals of schools in Lesotho are expected to perform are stated in the Education Act 2010. Section 21 of this Act outlines the duties of a school principal. The Act mandates the principal to manage and lead the school. It further mandates the principal to be a chief accounting officer for the use and control of school funds who is accountable to the school board. In executing the accountability mandate, the Act requires the principal to manage school finances transparently. Thus, the principal is expected to prepare an annual school budget and thereafter submit it to the school board for approval. Also, the principal is mandated to maintain and enforce discipline in the school. He/she is further empowered to discipline teachers in line with teachers' code of conduct (Lesotho Government, 2010).

Theoretical framework

In seeking to understand the perspectives of school principals about leadership in a rural context, this paper used a two-pronged theoretical framework consisting of an asset-based approach and distributed leadership theory. Distributed leadership theory is based on the idea that within a school, leadership is exercised by more than one person (Spillane, 2005). The said leaders include principals, deputies, Departmental Heads, some teachers, and learners. In this way, the totality of school leadership is dispersed among several leaders (Gronn & Hamilton, 2010). Formal and informal leaders share leadership responsibilities though some leaders such as principals may perform more leadership functions than others (Spillane & Orlina, 2005).

The asset-based approach was deemed appropriate as part of a theoretical framework in this paper. Instead of beginning with what is lacking in the community, the asset-based approach is based on the understanding that each community has assets that can be used to address its challenges. These assets may be in the form of talents, skills, and capacities that members of the given community possess (Kretzmann & McKnight, 1993). Schools located in rural contexts are also endowed with assets that they can draw from in tackling their challenges (Khanare, 2009) hence the opportunities for school principals to explore. It is about relationships that are defined by the talents and strengths of individuals and not weaknesses.

The asset-based approach does not imply that the community or schools do not require assistance from outside. It emphasises that the community should start with what it has before requesting assistance from elsewhere (Ebersöhn & Eloff, 2006).

The two theories constituted a suitable blend of a theoretical framework. Asset-based approach provided analytical tools to identify and explain assets, capacities and skills that the principals harnessed in pursuit of schools' goals. Distributed leadership theory was used to analyse and interpret the perspectives of the principals about leadership practices of formal and informal leaders in addressing schools' challenges as well as exploring the available opportunities.

Methodology

The paper is located within the interpretivist paradigm to understand the multiple perspectives of the participants about the phenomenon under the microscope (Guba & Lincoln, 2005). A qualitative approach was deemed suitable for this paper. As argued by Corbin and Strauss (2008) qualitative research allow the researchers to seek a detailed understanding of a phenomenon by visiting and interacting with people.

Purposive sampling was used to select four principals of schools located in the rural context of Lesotho. Creswell (2008) contends that purposive sampling is suitable for qualitative research where the researcher selects specific individuals or cases. The selected principals had more than five years of experience as school principals. In this way, they were knowledgeable about the phenomenon under investigation. Two female and two male principals served as the participants. The study was conducted in Lesotho, which is located within its only neighbour, Republic of South Africa. It is largely mountainous hence it is also referred to as the Kingdom in the sky. Sometimes the weather can be very unfavourable. In winter, for example, heavy snowfalls and traveling in the highlands become difficult. For organisation and management purposes, Lesotho is divided into ten districts. The four schools that served as research sites in this study are located in a rural context.

Data were generated through individual semi-structured interviews with the participant primary school principals. Semi-structured interviews allowed for flexibility and provided me with an opportunity to clarify questions and probe the participants. The interviews were transcribed and subjected to content analysis. Patton (2002) indicates that content analysis is an inductive process that allows patterns, themes and categories to emerge from data. The themes that emerged from the data will be presented and discussed in the following section.

In qualitative research, it is essential to ensure trustworthiness of the study. To this effect, I followed Lincoln and Guba's (2005) advice that member checking is one of the strategies that can be used to enhance trustworthiness. Thus, after transcribing the interviews I went back to the participants and requested them to verify the data and my initial interpretation. I also used voice recorder to capture interviews word by word. All ethical issues were followed. These include asking permission from relevant gatekeepers, informed consent, anonymity, and confidentiality (Cohen, Manion & Morrison, 2007).

Findings and Discussion

In line with the focus of this paper, the presentation and discussion of the findings are categorised into two broad themes: Challenges and opportunities. Consistent with ethical considerations, the participants were given pseudonyms as follows: Principal A, Principal B, Principal C, and Principal D.

Challenges

The findings revealed that schools in the rural context of Lesotho are faced with a multitude of challenges. These challenges include, but not limited to, poverty, shortage of resources, and extreme cold weather especially during the winter season when heavy snowfalls in some days. Highlighting some of the challenges, the participants had this to say:

“Most of the people in our community are unemployed and therefore they are unable to pay for somethings needed by the school which the government does not pay for. For example, when learners have to go for sporting activities most parents do not pay for their children” (Principal A).

“In this school, there are not enough classrooms to cater for all our learners. Some teachers share one classroom where they teach different groups of learners. In this way, the teaching and learning process is not smooth. I also have my share of teaching load” (Principal B).

“Some learners do not attend school properly due to family problems. Others walk long distances to and from school. We know that when it is raining our learners that travel for long-distance will not come to the school. It is even worse when it is snowing because all learners and teachers do not come to school” (Principal D).

The challenges seem to be a stumbling block to the smooth leadership and management of schools in the rural context. These findings are consistent with the previous studies (du Plessis, 2017, Mendiola et al., 2019), which found that principals of rural schools are faced with context-specific challenges. To navigate through these challenges the principals had to search for solutions within their immediate environment and beyond. I now turn to the opportunities that the participants identified and explored.

Opportunities

In my conversation with the participants, it emerged that they explored opportunities within schools, local communities, and beyond. Informed by the asset-based approach, I discuss these opportunities as assets that were harnessed and used by the participants in their conquest to realise organisational goals despite existing challenges. These opportunities include multi-tasking of teachers, social institutions, school clusters, and mobilisation of assets beyond the local communities.

Multi-tasking of teachers

When asked how they navigate the challenges of leading schools in the rural context, the participants mentioned multi-tasking as one of the opportunities that they promote and support. Due to low learner enrolments in the participant schools, there were relatively fewer teachers as compared to primary schools that have many learners. Thus, principals and teachers in the participant schools performed multiple tasks. Concerning teaching and classroom management, the participants reported:

“In managing multi-grade classes you must ensure that learners in each class have a task at any given learning time. You ensure that all the learners in different classrooms are occupied first by assigning them activities to do. When learners have been allocated tasks to do, the noise that they make in the absence of the teacher is

productive noise because it is related to learning. Then you rotate in the groups. It is a bit of a challenge especially to newly employed teachers. In this school, during staff meetings, I ask teachers to share the challenges and also what works about teaching and learning” (Principal C).

“There are two of us in this school and we teach from Grade 1 to Grade 7. Though I have administrative duties, I also teach Grade six and seven. My colleague teaches Grades one, two, three, and four. Grades one and two share one classroom. The same thing applies to Grades three and four” (Principal A).

“We have developed ways of teaching learners belonging to two different Grades in one classroom. For example, when planning for teaching you check common topics for classes that you teach. For example, if the syllabus for Grade 7 has nouns and Grade 6 syllabus also has a noun, you teach them together but allocate different class activities. Thereafter, you leave them doing activities and move to another class. Learner leaders are helpful since they keep order in the absence of the teacher” (Principal D).

Multi-grade teaching in rural schools is a challenge to many teachers because they have to teach learners with different learning abilities and grapple with a shortage of resources (Taole, 2018). Other tasks that the teachers performed include supervision of learners during the time allocated to study, extra-curricular activities, and fundraising activities. Principal C, for instance, was the only male teacher working with two female teachers. He reported that he coached the school soccer team and he was also responsible for supervising the school choir while other teachers also have supervisory roles that they perform. In all four schools, the task of supervising learners during the time allocated for the study was performed by all the teachers. Due to the shortage of funds that schools received from the Government all schools engage in fundraising activities where teachers and learners actively participated. Principal A, for instance, reported that: “The Government allocates M20 (1.05 USD) per child per year. This money is not enough to cater for school expenses. We have to supplement it through fundraising activities”. Lesotho Government introduced free primary education in 2000 and as such public primary schools do not collect school fees. In this way, fundraising is essential. The common fundraising activity in the four schools was holding of concerts where school choirs entertained people. The school choirs were made up of learners.

In seeking to address the seemingly insurmountable challenges, the participants, other teachers, and learners adopted a multi-tasking working approach which created an opportunity for harnessing and use of assets within the school. As rightly argued by Chikoko and Khanare (2006) each school has various assets that can be used to address their challenges. The principals and teachers were assets that performed multiple roles in pursuit of school goals. Principal C facilitated meetings where the talents of teachers in teaching multi-grade were explored. In an effort, to raise funds in the three schools the learners proved to be essential assets wherein their talents in singing contributed to fundraising activities.

Social institutions as assets

The local community served as an important asset that the schools sought for support. In particular, the existing social institutions that the members of the community used to collaboratively address that challenges were also used by the principals for the benefit of schools. The four participants indicated that they used “Letsema” (Community collaborative

work) and “Pitso” (Public assembly) to solicit the members of the community’s support for school needs and projects.

“Letsema’ (Community collaborative work) practice.

The participants used the practice of letsema as an opportunity to harness free labour from members of the community to partake in the school projects. The practice of Letsema can be traced from precolonial Lesotho. Mothibe (2002) contends that Letsema was free labour that the subjects (ruled people) in precolonial Lesotho provided to the chiefs (rulers) through working on the chiefs’ fields. Mothibe (2002) further argues that Letsema was compulsory for all the subjects. Due to ever-changing socioeconomic practices, Letsema has also evolved and any person in the community can invite people to assist him or her. Such a person is only required to provide food to the people that would volunteer to assist him. Those who are assisted through Letsema are also expected to return a favour when they are invited to take part in Letsema organised by other members of the community. The participant principals identified Letsema practice as a useful opportunity. Principal A, for example, told me that:

“The community assisted us to prepare the land for vegetable production. We spoke to the community about the importance of having a vegetable garden in the school. The members of the community, teachers, and learners worked together to prepare the land for vegetable production. Members of the community from villages around the school organised “matsema” (Community collaborative work) to work on vegetable project. They provided food to the workers. They brought their tools and waste materials to make composed manure. Two gentlemen had knowledge about agricultural issues. These men and teachers guided the community on the proper ways of vegetable production”.

The shortage of financial resources in the participant primary schools implies that they could not afford to employ people to work on school projects. In a community ravaged by poverty and unemployment, people are often busy with bread and butter issues daily and as such providing community service may not appeal to them. However, through ‘letsema’ members of the communities provided free labour to the schools. While acknowledging that communities have challenges, the essence of the asset-based approach is to start with that which the communities have (Kretzmann & McKnight, 1993). In this regard, the practice of letsema can be seen as an opportunity that enabled the school principals to harness human resources from members of the community and use the said resources for the development of the schools. As observed by Ebersöhn and Eloff (2006) asset-based approach stresses the importance of identifying available resources and capacities to redirect them to the existing opportunities. Distributed leadership was apparent in how leadership responsibilities were spread across two knowledgeable members of the community and the teachers.

Pitso (public assembly)

Pitso is a public forum where matters of interest or challenges are debated and a collective decision is made (Letseka, 2013). It is commonly used in rural areas. It emerged from my conversation with the participants that they explored pitso as a platform to engage with the local communities. While they listened to the public debates, they also presented school needs to the members of the community. The two male principals who actively participated in pitso stated:

“I attend pitso with members of the community. I listen to members of the community discuss matters that affect them. I also take advantage of pitso to talk to the community

about school issues that should be known by all members of the community. For example, our school is located some distance from the villages. During school holidays, people that we did not know used to break the windows and steal somethings from the school. When the school reopened during one pitso, I raised this matter. I explained the importance of education and the availability of a school within the community. Some members of the community also stressed the need for each member of the community to ensure that the school property is safe during school holidays. Since then we have never had anything stolen from the school, but we do not have a security guard' (Principal A).

"I attend the pitso because I am also a member of this community since I have a family here. If there are things that members of the community want to know about the school, I explain them at pitso. However, we also have parents' meetings where we discuss education matters with parents. Parents' meetings are attended only by parents who have children in the school only while pitso are open for all members of the community" (Principal B).

The participants in this study demonstrated their ability to lead schools in rural context through the use of the existing social institution. This institution provided an appropriate forum through which the principals mobilised and influenced the members of the community to address problems encountered by the schools. Although principals C and D, both of them females, attended the pitso, they reported that they never participated in the debates. Despite visible democratic gains and women empowerment in Africa in general and Lesotho in particular, patriarchy is still entrenched in the African communities especially in rural contexts (Makhasane, et al., 2018; Moorosi, 2010). As a result, men still dominate social relationships. It thus appears that to a certain extend women principals in rural Lesotho had restrictions in exploring some opportunities and mobilising assets in forums such as pitso.

School Clusters

The finding from the interviews with the principals also revealed that the Ministry of Education and Training divided schools in the district into clusters. These clusters provided schools with opportunities to collaborate, network, share challenges, and success stories. In relation to teaching and learning opportunities emanating from clustering, Principal A had this to say:

"At the beginning of each school term, teachers in our cluster meet and plan for teaching and assessment. At the end of each school term, learners in our cluster are given common tests. In these meetings, teachers also talk about challenges and effective teaching strategies".

The participants also reported that the principals of primary schools in the cluster have regular meetings where they discuss leadership and management issues. This implies that principals also have an opportunity to learn from one another and to deliberate on strategies that they can adopt to tackle common challenges. In a nutshell, beyond a given school other teachers and principals in the cluster served as assets.

Mobilising assets beyond the local community

The participants acknowledged the role of the Ministry of Education and Training in providing financial and curriculum-related support. However, they also highlighted the initiatives taken by the schools to secure financial support from donors for school

development projects. In particular, two principals identified some projects in their schools that were funded by external donors:

The two water tanks that we have in this school were funded by an organisation that we approached and requested assistance. The organisation also built new toilets for staff and learners (Principal A).

The classrooms that you see in this school were funded by the donors. We wrote letters to several donors requesting assistance with classrooms and finally, we got the assistance (Principal D).

Even though schools have the assets that they can harness to address their challenges, they still require assistance from outside (Ebersöhn, & Eloff, 2006). It is interesting to note that the two schools identified their challenges and took an initiative to look for funding.

Conclusion

This paper explored Principals' perspectives regarding leading schools in the rural context. The principals were aware of the multiple challenges that schools faced. The principals in collaboration with other stakeholders navigated through the challenges either by addressing such challenges or by finding survival strategies. In seeking to address the challenges, the principals, working together with others, explored opportunities at schools and beyond the schools' levels. At the schools' level, principals, teachers, and learners were identified as important assets in the participant schools. Teachers and learners contributed to the development projects of the schools and fundraising activities. The principals created an environment where teachers and learners can use their talents and knowledge in pursuit of organisational goals. Beyond the schools, the principals were found to be effective in mobilising members of the communities to support schools. Interestingly, distributed leadership was apparent in all the participant schools. Leadership was dispersed across the principals and teachers in performing such tasks as teaching, supervision of the study, extracurricular activities, and fundraising activities. In mobilising members of the community, the principals played a major role. It can, therefore, be concluded that the principals were cognisant of the prevailing challenges in rural schools, but they adopted context-specific strategies to address the said challenges.

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INFORMATION AND COMMUNICATION TECHNOLOGY UTILIZATION AND EFFECTIVE TEACHING AND LEARNING IN FEDERAL CAPITAL TERRITORY PRIMARY SCHOOLS, ABUJA, NIGERIA

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Abstract

The study determined the Information and Communication Technology (ICT) utilization and effective teaching and learning in Federal Capital Territory (FCT) primary schools, Abuja, Nigeria. In this study, two research questions were addressed while one hypothesis was tested. Correlational and descriptive survey research designs were adopted. A sample of 400 teachers was randomly selected from the selected primary schools in AMAC, FCT as the sample for the study. The data for the study were gathered through the copies of questionnaire that were distributed to the teachers in the chosen schools. The questionnaire tagged “Information and Communication Technology, and Teaching and Learning Questionnaire (ICTTLQ)” was pilot tested and a reliability coefficient of .85 was obtained. Mean, standard deviation and Pearson’s product-moment correlation co-efficient were used for data analysis. The study ascertained that there was a significant relationship between ICT utilization and effective teaching and learning in FCT primary schools. This means that teachers’ ICT utilization could enhance effective teaching and learning in FCT primary schools. It was recommended that, school administrators in collaboration with the government should encourage teachers’ ICT utilization in FCT primary schools especially in public schools to facilitate effective teaching and learning.

Keywords: *Effective Teaching and Learning, Information and Communication Technology (ICT), Primary schools and Utilization.*

Introduction

Education could be a necessary tool in revitalizing the expansion of any population. The “structure of educational system in Nigeria is in numerous levels like pre-primary, primary, secondary and tertiary levels” (Federal Republic of Nigeria [FRN], 2004, p. 2). Primary education is that the education given within the institutions for kids aged 6 to 11 plus which shall be of six years duration (FRN, 2004). The sector of education has been suffering from information and communication technologies (ICTs), “which have unquestionably affected teaching, learning and research” (Yusuf, 2005, p. 315). The achievement of the primary school goals is decided by the way in which the pinnacle teachers who are the chief executive officers are capable of applying the suitable ICT resources within the school administration and operations, especially teaching and learning. Many studies have shown benefits of ICT for effective teaching and learning in Nigerian primary schools. Therefore, the requirement for ICT utilization in teaching and learning in primary schools in Federal Capital Territory (FCT), Nigeria can’t be overemphasized.

According to Adomi (2010), ICTs are electronic technologies used for data storage and retrieval. ICTs include all “tools that we use to speak or dissipate information like the radio, television, telephones, overhead projectors, video cameras, video players, and computers” (Ogunshola, 2015, p. 84). ICT has the “ability to improve and deepen skills to motivate students, and also strengthening teaching and learning as well as helping schools change” (Davis & Tearle as cited in Yusuf, 2005, p. 315).

The teaching and learning within the Nigerian primary schools most significantly in recent time, have developed within the methodology of practice and theory. ICT utilization in primary education means “technology-based teaching and learning process that closely correlates to the employment of learning technologies in schools” (Ghavifekr & Rosdy, 2015, p. 175). Additionally, ICT gives assistant to both teachers and students with the aid of the computers and other devices to serve the purpose of learning tools (Jorge, Gutiérrez, García, Jorge, & Díaz, 2003). This study therefore, examined the ICT utilization and effective teaching and learning in FCT primary schools, Abuja, Nigeria.

Statement of the Problem

The role of ICT in enhancing teaching and learning in primary schools in FCT can't be ignored. Despite the numerous influence of ICT within the educational sectors within the world, Nigeria is yet to effectively incorporate the utilization of ICT into the tutorial system because of challenges teachers face within the utilization of ICT. A number of these challenges in step with to Ogunshola (2015) are; cost, weak infrastructure, lack of skills, lack of relevant software and limited access to the web. Furthermore, In FCT, most primary schools teachers barely use ICT resources in enhancing teaching and learning activities. Moreover, the role of teachers is crucial in achieving effective teaching and learning in primary schools in Nigeria. ICTs are perceived as significant tools that assist the progress from conventional method of teaching (teacher-centred) to modern method of teaching (learner-centered) in primary schools. Thus, the head teachers and teachers in FCT are required to understand the utilization of ICT for effective administration of primary schools. This can be necessary within the area of teaching and learning which might be done through the effective utilization of ICT tools within the classroom. This study investigated the ICT utilization and effective teaching and learning in FCT primary schools, Abuja, Nigeria.

Purpose of the Study

This study addressed the subsequent objectives:

1. Establish the extent of ICT Utilization by teachers in FCT primary schools.
2. Establish the level of teaching and learning with ICT in FCT primary schools.
3. Ascertain if there is any significant relationship between teachers' ICT utilization and effective teaching and learning in FCT primary schools.
- 4.

Research Questions

The following research questions guided the study:

1. What is the teachers' extent of ICT utilization in FCT primary schools?
2. What is the level of teaching and learning with ICT in FCT primary schools?
- 3.

Hypothesis

H₀₁: There is no significant relationship between teachers' ICT utilization and effective teaching and learning in FCT primary schools.

Theoretical Framework

The ICT model by UNESCO (2002) called “the Stages of Teaching and Learning with and through ICT” (p.16) is presented during this study. “This model is presented in four stages.

a. Discovering ICT tools

In the first stage, teachers and pupils undergo the development of ICT in discovering ICT tool and their general functions and uses. During discovery stage, there's usually a stress on ICT

literacy and basic skills. This stage is connected with the emerging approach in the development of ICT.

b. Learning the way to use ICT tools

This stage involves learning the way to use ICT tools and starting to

c. Knowing how and when to use ICT tools

The next stage is knowing how and when to use ICT tools to realize a specific purpose such like in completing a given project. This stage implies the power to acknowledge situations where ICT are going to be helpful, choosing the foremost appropriate tools for a specific task, and using these tools together to unravel real problems. This stage is linked with the infusing and reworking approaches in ICT development.

d. Specializing in the use of ICT tools

The fourth and last stage involves specializing within the use of ICT tools which occurs when one enters more deeply into the science that makes and supports ICT. During this stage, teachers teach ICT as a topic while students study ICT as a subject matter to become specialists. Such study concerns vocational or professional education instead of general education and is sort of different from previous stages involving the employment of ICT tools.” (pp. 16-17)

Methodology

The correlational and descriptive survey research designs were used in this study to determine the relationship between ICT utilization and effective teaching and learning in FCT primary schools. The study population was made of all the 3781 teachers in public and private in AMAC, FCT. A sample of 40 primary schools in AMAC, FCT was used. Ferguson (as cited in Ogunshola, 2015) suggested that 10% of institutions in a study would be appropriate, thus, making 29% of the population. Disproportionate stratified and simple random sampling techniques were employed to select the 40 primary schools (20 public primary schools and 20 private primary schools) and 400 teachers (200 teachers from public primary schools and 200 from private primary schools).

However, a questionnaire that was drafted by the researchers was used to obtain necessary information from the teachers. The questionnaire was labeled “Information and Communication Technology, and Teaching and Learning Questionnaire” (ICTTLQ), and it was administered to teachers. The ICTTLQ made up of three sections (A to C). In section A, items 1-2 covered personal information of the teachers while section B covered items 3–19, which were used to measure the level of teachers’ ICT utilization and section C covered items 20-30, which were used to measure teaching and learning with ICT. A 4 point Likert scale was used to obtain responses from the teachers such as Never is 1 point, Rarely is 2 points, Moderately is 3 points and To very large extent is 4 points while Strongly Disagree is 1 point, Disagree is 2points, Agree is 3 points and Strongly Agree is 4 points. The validity of the instrument adopted was content validity. The reliability coefficient of ICTTLQ was .85, using Cronbach’s alpha.

The descriptive statistics used to answer the question questions were frequency, percentage, mean and standard deviation (SD) while the inferential statistic used to test the hypothesis at .05 level of significance was Pearson’s product-moment correlation coefficient (r). The rule of explanation of the findings of the data analysis is that a mean score of below 2.50 was considered as rarely/disagree while 2.50 and over was considered as moderately/agree. The

calculated probability (p-value) that was lower than the level of significance of .05 was rejected while the p-value that was larger than the level of significance of .05 was not rejected.

Results

Research Question One

What is the teachers' extent of ICT utilization in FCT primary schools?

Table 1: Teachers' Extent of ICT Utilization in FCT Primary Schools

S/N	Items	Mean	SD	Decision
3.	I use desktop/laptop for teaching of my subject area and research.	2.32	1.08	Rarely
4.	I use television as instructional materials to enhance teaching and learning.	2.41	1.15	Rarely
5.	I use mobile phone/handset to send text messages and call the parents and staff regarding teaching and learning.	3.61	1.11	To Very Large Extent
6.	I use intercom gadget to speak with students and staff in the school compound.	2.33	1.10	Rarely
7.	I use internet facilities for research and teaching and learning.	3.05	1.09	Moderately
8.	I use photocopy machine for reproduction of documents for teaching and learning.	3.08	1.11	Moderately
9.	I use printer machine for printing of documents for teaching and learning.	3.25	1.11	Moderately
10.	I encourage the pupils to use the library for reading, and I also use the library for study.	3.45	1.12	Moderately
11.	I use books and electronic library to improve my teaching method and for research.	2.54	1.08	Moderately
12.	I use overhead projector as an instructional material for teaching and learning.	2.42	1.07	Rarely
13.	I use electronic Board (Star Board, Smart Board) as instructional material.	2.46	1.10	Rarely
14.	I use scanning machine to scan necessary documents meant for teaching and learning.	2.45	1.13	Rarely
15.	I use camera to cover class activities and school events when necessary e.g. sports, seminar, excursion	2.77	1.12	Moderately
16.	I use microphone to address the pupils and staff during Assembly.	2.67	1.10	Moderately
17.	I use radio/tape recorder for students to learn relevant languages, voice auditioning and news casting.	2.18	1.09	Rarely
18.	I use board (bulletin, notice, black and white) to pass information on timetables, meetings and inter house sports.	3.50	1.13	Moderately
Sectional Mean		2.78	1.11	Moderately

Table 1 presents the sectional mean score of 2.78 for the extent of ICT utilization by teachers in FCT primary schools, which is higher than the 2.50 decision rule. This study revealed moderate extent of ICT utilization by teachers in FCT primary schools.

Research Question Two

What is the level of teaching and learning with ICT in FCT primary schools?

Table 2: Analysis of Teaching and Learning with ICT in FCT Primary Schools

S/N	Items	Mean	SD	Decision
The Use of ICT Resources:				
19.	Help the pupils to learn more effectively	3.65	1.09	Strongly Agree
20.	Allows the pupils to be more creative and innovative.	3.49	1.10	Agree
21.	Encourage the pupils to converse more with their classmates.	3.50	1.13	Strongly Agree
22.	Motivate the pupils to interact actively during the lesson activities.	3.47	1.12	Agree
23.	Help to improve pupils' abilities especially in reading, writing and drawing.	3.57	1.15	Strongly Agree
24.	Help the pupils to be more attentive during lessons	3.45	1.08	Agree
25.	Help to broaden pupils' knowledge pattern.	3.30	1.11	Agree
26.	Help to make pupils more focus and understand better.	3.50	1.10	Strongly Agree
27.	Assist the pupils to find related information and knowledge for learning.	3.50	1.12	Strongly Agree
28.	Enable the pupils to express their intentions and thoughts better.	3.43	1.11	Agree
29.	Increases pupils' interest to involve actively in the class.	3.47	1.12	Agree
Sectional Mean		3.48	1.11	Agree

Table 2 presents the sectional mean score of 3.48 for the level of teaching and learning with ICT in FCT primary schools, which is higher than the 2.50 decision rule. The study revealed that the level of teaching and learning with ICT in FCT primary schools was effective because most of the teachers agreed to the utilization of ICT for teaching and learning, and also agreed that the utilization of ICT could enhance teaching and learning.

H₀₁: There is no significant relationship between teachers' ICT utilization and effective teaching and learning in FCT primary schools.

Table 3: Relationship between Teachers' ICT Utilization and Effective Teaching and Learning in FCT Primary Schools

Group	N	Mean	SD	r	p-value	Decision
Teachers' ICT Utilization	400	2.86	1.11			H ₀₁
Effective teaching and Learning	400	3.48	1.11	0.75	0.02	Rejected

Table 3 shows the relationship between teachers' ICT utilization and effective teaching and learning in FCT primary schools. The study showed a positive relationship between teachers' ICT utilization and effective teaching and learning in FCT primary schools because the calculated Pearson's product-moment correlation (r) was 0.75. Furthermore, the p -value of 0.02 is below 0.05 level of significance. This implies that there is a significant relationship between teachers' ICT utilization, and effective teaching and learning in FCT primary schools. The null hypothesis was rejected. The study revealed that teachers' ICT utilization could enhance effective teaching and learning in FCT primary schools.

Discussion of Findings

From the analysis of information, this study showed that the extent of ICT utilization by teachers in FCT primary schools was moderate. The findings of the study agreed with the findings of Ghavifekr and Rosdy (2015) that showed "that most teachers are conscious of the usefulness of ICT in teaching which implied that they realized that the utilization of ICT supports the teachers to enhance teaching with more updated materials" (p. 183). The study showed that the extent of teaching and learning with ICT in FCT primary schools was effective because most of the teachers agreed to the utilization of ICT for teaching and learning, and also agreed that the utilization of ICT could enhance teaching and learning. This study supported the study of Ghavifekr and Rosdy (2015) that "most teachers agreed that the employment of ICT in teaching and learning could enable the pupils to be more active and interesting within the lesson and that they also agreed that the utilization of ICT provide the possibilities for pupils to move and take more parts or roles for his or her best learning experience" (p. 183).

The findings of this study concluded that there was a major relationship between teachers' ICT utilization and effective teaching and learning in FCT primary schools. This implied that the utilization of ICT resources could enhance effective teaching and learning in FCT primary schools. This finding is in alignment with the findings of Ghavifekr and Rosdy (2015) that "technology-based aids teaching and learning to be more practical compare to traditional classroom. This can be because, using ICT resources will prepare a lively learning domain that's more engrossing and effective for both teachers and students" (p.188).

Conclusion

ICT provides teachers with new sources of information and knowledge. Most of the teachers in FCT primary schools are faced with challenges in the use of ICT because they do not have relevant ICT skills and knowledge. However, the study found that there was a significant relationship between teachers' ICT utilization and effective teaching and learning in FCT primary schools, which led the researchers to conclude that teachers' ICT utilization could enhance effective teaching and learning in FCT primary schools. Also, if the level of teachers' ICT utilization is improved, effective teaching and learning in FCT primary schools would be improved.

Recommendations

The following recommendations were made:

1. The school administrators in collaboration with the government should encourage teachers' ICT utilization in FCT primary schools especially in public schools to facilitate effective teaching and learning.
2. Teachers in FCT primary schools should learn to upgrade their knowledge of ICT utilization as required for effective teaching and learning.

3. There should be provisions for training of teachers in the use of ICT for effective teaching and learning in FCT primary schools through conference, seminar and workshop.

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THE OVERALL EFFECT OF TRANSFORMATION APPROACH ON GRADE 10 LEARNERS' ACADEMIC ACHIEVEMENT IN SOLVING HYPERBOLA FUNCTIONS

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Abstract

This paper shed light on the effectiveness of transformation approach as an intervention to improve Grade 10 learners' academic achievement in solving hyperbola graphs. Polya's four steps of problem-solving strategy underpins the study, which was conducted using a mixed methods research design. A pre-test and post-test were administered in both the experimental group (n=168) and control group (n=173) in two separate schools in the same day in the same order to avoid the contamination of results. After the intervention, twenty-five learners, that is, five from each school, were purposively sampled to participate in the focused-group interviews. The collected data were quantitatively analysed using a Wilcoxon-Rank Sum test for the pre-test and post-test results. The findings revealed that transformation approach in the experimental group had a positive effect on improving learners' academic achievement in solving hyperbola functions. The study suggests that transformation approach can be used in other schools to see if it could yield same results as in this study.

Keywords: functions; hyperbola graphs; transformation approach; reflection; translation

Introduction

Transformation in this study is an approach to teaching that emanates from a unifying topic in the middle school geometry curriculum (Wu, 2005). Yanik (2011) postulates that transformation approach contributes to learners' reasoning and justification. Transformation approach was found to yield positive results when teaching geometry concepts in a study by Seago, Nikula, Matassa and Jacobs' (2012). Ada and Hurtulus (2010) concur that teaching using transformation approach has a positive effect in mathematics learning and it includes rotation, reflection, translation, and dilation. In this study, the researcher used transformation approach as an intervention to improve Grade 10 hyperbola functions performance as seen to be one of the functions that is problematic to learners. This is supported by 2018 National Senior Certificate diagnostic report revealed that Grade 12 learners have challenges when solving hyperbola function problems, such as the effect of different parameters affecting the basic graphs (Department of Basic Education, DBE, 2018). The diagnostic report suggested that teachers should link hyperbolic functions with transformation.

This study explored the effect of transformation approach as a strategy to improve Grade 10 performance when solving hyperbolic functions. The study answered the research question: what is the effect of transformation approach on Grade 10 learners' performance in Capricorn District of Limpopo Province? The importance of conducting this study was to prepare learners to understand the interpretation of graphs, and to answer questions based on those graphs so as to improve performance in Grade 11 and Grade 12. Furthermore, this study aimed to address the challenges learners faced when dealing with hyperbolic functions.

Grade 10 hyperbola functions are regarded as an important section prescribed in Mathematics in schools, and therefore it should be taught with understanding (Department of Basic Education [DBE] 2011). Learners are expected to be able to define functions and make distinctions between the different types of functions. Holliday, Cuevas, Moore-Harris, Carter, Marks and Casey (2005) define functions as the relationships between the input and output

variables, in which one output value depends on an input value. Although functions form a major part of school mathematics and must be taught effectively, learners seem to have trouble in solving problems related to them (National Council of Teachers of Mathematics [NCTM] 2010). Mulaudzi, Dube, Mavhungu and Mogari (2016) suggest that one of the possible reasons why learners find functions difficult may be the use of outdated methods of classroom teaching. Furthermore, Tarmizi, Ayub, Bakar and Yunus (2010) reiterate that these outdated teaching methods follow a traditional paper-and-pencil approach. This approach may contribute towards learners' difficulty in learning functions, as seen as a manual procedure to plot graphs. The manual procedure uses points, x – *intercepts* and y – *intercepts* or other parameters that are used to plot the graphs.

Mudaly and Rampersad (2010) studied the role of visualisation in learners' conceptual understanding of relationships in graphs. I report that learners are fixated with the physical attributes (visuals) of graphs and ignore the mathematisation process behind those graphs. The results of Mudaly and Rampersad's study (2010) reveal that there is a disconnect between the use of physical attributes such as technological tools, and the mathematics that is used to represent them. The study shows that the effect of visualisation is not given attention when teaching graphs. Mudaly (2014) further investigated the role of visualisation of functions in mathematics using semiotic mediation. Mudaly's (2014) study argues that semiotic mediation has a positive impact on learners' understanding of graphs and provide a useful foundation to make sense of learners' responses. However, the relationship of graphs through transformations such as translation, reflection, and rotation is given little attention when teaching Grade 10 hyperbolic functions. This article offers new insight into the use of translation and reflection in the teaching of hyperbolic functions to improve learner performance.

In this paper, hyperbolic functions are explored through the concept of reflection and translation of transformation used in geometry. Hyperbolic functions are expressed in the form $f(x) = \frac{k}{x \pm p} \pm q$, in which p and q are asymptotic points. Mulaudzi et al. (2016) argue that learners' plotting of hyperbolic graphs appears to be laborious and time-consuming. They further state that learners use repeated algorithmic computations, and points to plot the graphs using pencil and paper. The use of pencil and paper not only hinders learners' understanding of graphs, but also contributes to learners' negative attitude towards mathematics, including graphs (Mogari, Kriek, Stols & Ogbonnaya, 2009). Mulaudzi et al. (2016) found this pencil-and-paper approach in plotting graphs to be ineffective, as most learners do not perform well on hyperbolic graphs. In this paper, relating to graphs through transformations may reinforce learners' understanding of graphs and hence improve their performance in hyperbolic functions problems. Polya's (1973) four steps of problem-solving, such as understanding, analysing, executing and reflecting on the problem, are used to look at the data collected in Grade 10 mathematics classes in the five schools.

Polya's approach to problem solving

Polya's (1973) problem-solving approach underpins this study, outlining four steps to problem-solving, namely: understanding or identifying a problem, analysing a problem, executing a problem, and reflecting on a problem. The approach was preferred, as the intervention was implemented in order for learners to understand hyperbolic functions $f(x) = \frac{k}{x}$ and analyse the translations and reflections of the graph $f(x) = \frac{k}{x}$ as $(x) = \frac{k}{x} \pm q$. Polya's model was used to identify the difficulties Grade 10 learners were faced with in solving problems related to hyperbolic functions, especially in analysing and interpreting the

translated and reflected graphs. Furthermore, this model enabled the researcher to understand how learners analysed and executed hyperbolic function problems. These steps require learners to be able to solve problems such as drawing hyperbolic functions $f(x) = \frac{a}{x}$, their translation either upwards $f(x) = \frac{a}{x} + q$ or downwards $f(x) = \frac{a}{x} - q$, the reflection of the function either about the x – axis or y – axis with the new equation $f(x) = -\frac{a}{x}$ as well as the horizontal asymptote. This is an example used for transforming hyperbolic function when it is translated and reflected (Wu 2005; Yanik 2011). In this study, translation is defined as the movement of hyperbola graphs either upwards or downwards and reflection as the mirror image of the graphs either about the x – axis or y – axis. Green and Gilhoolly (2005) say these types of problems were not seen as challenging to Grade 10 learners to solve, but note that the approaches used to teach hyperbolic function was a problem for learners to solve difficult tasks.

Transformation as a Teaching Approach to the Hyperbolic Concept

The literature review focused on transformation as an approach to be used in the teaching and learning of functions, including hyperbola functions. Transformation is a unifying topic in the middle school geometry curriculum (Wu 2005). Yanik (2011) argues that transformational geometry is another area of geometry that contributes to learners’ reasoning and justification skills. Transformation provides learners with opportunities to describe patterns, discover basic features, make generalisations, and develop spatial competencies (Portnoy, Grundmeier & Graham 2006). The NCTM (2010) states that instructional activities in mathematics ought to encourage learners to apply transformations and also use symmetry to analyse mathematical situations when solving problems. The descriptions used to describe transformation by the authors above enabled the researcher to understand how to teach Grade 10 hyperbolic functions using transformation. The authors describe transformation as belonging to the area of geometry, but transformation is not seen as an approach that could be used to teach other concepts, such as functions.

Seago, Nikula, Matassa and Jacobs (2012) used a transformation approach in their study to teach geometry concepts. Other studies have found that teaching using transformations, which include rotation, reflection, translation and dilation, has a positive effect on learners’ learning of mathematical topics (Ada & Hurtulus, 2010). Seago, Driscoll and Jacobs (2012) used video cases to extend teachers’ knowledge of geometric transformations and support them applying a transformation approach to teaching mathematics. The video cases used to develop teachers’ mathematical knowledge resulted in a positive gain in teachers’ understanding of this challenging content (Seago et al. 2012). The transformation approach in this study is used to teach Grade 10 hyperbolic functions, with the aim of improving learners’ performance.

As part of the intervention, five teachers in the experimental group used a transformation approach to teach hyperbolic functions in Grade 10 mathematics classes. This approach was used to reinforce learners’ understanding of the hyperbolic functions and also to analyse and interpret any given problems related to them. The other reason is that graphs transform without learners understanding how they have changed. The transformation approach used was adopted from transformation in geometry, as learners were taught this in grades 8 and 9. Hyperbolic functions are defined as graphs that are written in the general form $f(x) = \frac{a}{x} \pm q$, where a and q are constants (Jenkin, Van Zyl & Scheffler 2012). The effects of a on the shape and quadrants as well as the effects of q on the vertical shift were explained. Examples

such as $f(x) = \frac{9}{x}$, $f(x) = -\frac{8}{x}$ and $f(x) = \frac{12}{x}$ were used to engage learners in the group discussion. The learners were also asked to discuss the effects of a and q in the given functions, as well as in the asymptotes.

The reflections and translations were the forms of transformation used to explain hyperbolic functions. The teachers used $f(x) = \frac{9}{x}$, $f(x) = -\frac{8}{x}$ and $f(x) = \frac{12}{x}$ and some similar examples used by other teachers to explain the translations and reflections of the functions to the learners instead of just using points. Learners were asked to discuss the functions so as to observe their transformations, either translated or reflected. The functions were translated upwards, in which the function $f(x) = \frac{a}{c}$ became $f(x) = \frac{a}{c} + q$, and when it was translated downwards, it became $f(x) = \frac{a}{c} - q$. The value of $y = \pm q$ in the function is the horizontal asymptote and determines the translation of the graph. Learners were asked to translate the function $f(x) = \frac{9}{x}$ one unit upwards and downwards in their groups without using points. The translated function $f(x)$ upwards changed to be $f(x) = \frac{9}{x} + 1$, in which $y = 1$ was a horizontal asymptote above the $x - axis$, while downwards translation was $f(x) = \frac{9}{x} - 1$, in which $y = -1$ was also a horizontal asymptote below the $y - axis$. At Grade 10 level, learners are expected to translate the graphs upwards and downwards and also to reflect the graph about the $x - axis$ and $y - axis$.

The teachers also reflected the function about the $x - axis$ and $y - axis$, $f(x) = -\frac{a}{x}$ for both $axes$, in which the value of $a < 0$ became negative in the function $f(x)$ and was $f(x) = -\frac{9}{x}$ for both reflections. Learners were given the reflected function $f(x) = -\frac{9}{x}$, $f(x) = \frac{8}{x}$ and $f(x) = -\frac{12}{x}$ in groups to discuss and observe the movement of the graphs. The learners were given a chance to use points to observe the behaviour of the graphs.

Methods

The study was embedded in a pragmatic paradigm in which data were analysed using various methods of analysis. Mixed-methods research design was followed, where the researcher has collected both quantitative data and qualitative data in response to the research question (Creswell & Creswell, 2018). The pre-test and post-test were administered to the two groups, those are experimental and control groups at the same time in the same order, which aids in assessing the similarity between the two groups (Wiersma & Jurs 2009). Moreover, the post-test measures the effectiveness of the intervention in terms scores comparing the scores found in the pre-test.

Five secondary schools (A–E) were purposefully selected to participate as the experimental group. The other five schools (F–J) were also purposefully selected to participate as the control group. The sampled schools were drawn from the schools that had performed poorly in National Grade 12 mathematics for three consecutive years; they obtained less than 50% in average from 2013 to 2015 in Capricorn District. The control group was 40 kilometres away from the experimental group with the purpose of avoiding contamination of results, hence the two groups had little chance of coming into contact during the study. The experimental group was requested not to inform anyone outside the study about the intervention, including by using electronic devices such as cellular phones.

The tool used to gather data during a pre-test and post-test consisted of eight question items that were administered to both the experimental and the control group. Prior to administering the pre-test and post-test, the instrument was piloted in two schools that did not participate in the main study. Again, the researcher and teachers in the participating schools invigilated all the test sessions. In addition, 168 learners participated in the experimental group, and 173 learners participated in the control group. Five learners from each school, amounting to 25 in total, were selected to participate in a focus group interviews based on the intervention strategy. Ritchie, Lewis, McNaughton Nichols and Ormston (2014) advocate that data are generated by interaction between group participants and those “participants asks questions of each other, seek clarification, comment on what they have heard and prompt others to reveal more”. This had enabled learners to engage more on how learning of hyperbolic functions had an impact using transformation approach to improve learning and performance.

Findings

The collected data are analysed using the Wilcoxon-Rank Sum test for statistics to test for statistical significance. All the variables are not normally distributed (all p -values are less than 0.05). The use of a parametric test is warranted due to this normality distribution. The Rank Sum Test is used to compare the two study groups. Furthermore, the interpretation is performed at a 95% confidence limit. Two permutations were used to analyse the statistical data, the difference between the two study groups.

Table 1: Analysis of pre-test and post-test results (Q1)

Schools	obs	Rank-Sum	Expected	obs	Rank-sum	Expected
Experimental	168	10404.5	10610	168	13192.5	10610
Control	173	10512.5	10509	173	10608.5	10509
Combined	341	21119	21119	341	21521	21119
<i>p-value</i>		<i>0.2463</i>	<i>p-value</i>		<i>0.0000</i>	

The results of the pre-test in Table 1 revealed no significant difference between the two study groups (p – value = 0.2463) greater than a p – value 0.05 at a 95% confidence limit. The control group has recorded a significantly high score ($Rank-Sum = 10512.5$) when compared to the experimental group ($Rank-Sum = 10404.5$), which suggests that the experimental group performed poorly in the pre-test, before the intervention. This shows that some learners in the experimental group had grappled with understanding how to find the x - and- y -intercepts, points of asymptotes, and axis of symmetry when drawing hyperbola functions.

Post-test results shows a significant difference between the two groups (p – value = 0.0000), less that the p -value 0.005 at a 95% confidence limit. The experimental group recorded a significantly higher score ($Rank-Sum = 13192.5$) than the control group after the intervention ($Rank-Sum = 10608.5$). Though the experimental group performed poorly in Q1 before the intervention, the group showed an improvement in the post-test, when compared to the pre-test results in Q1. The results after the intervention in the post-test suggested that transformation approach had a positive impact in improving the learners’ performance in Grade 10 hyperbola functions. Table 2 below presents the analysis of Q2 on x - and- y -intercepts, points of asymptotes and axis of symmetry of a transformed hyperbola functions.

Table 2: Analysis of pre- post-test results Q2

Schools	obs	Rank-Sum	Expected	obs	Rank-sum	Expected
Experimental	168	7723.5	8255	168	12628.5	8255
Control	173	7946.5	7415	173	9327.5	15670
Combined	341	15670	15670	341	21956	15670
<i>p-value</i>		<i>0.1354</i>	<i>p-value</i>		<i>0.0009</i>	

The results before the intervention for Q2 in the pre-test indicated no significant difference between the two study groups ($p - value = 0.1354$), less than $p - value 0.05$ suggesting that the two groups displayed similar results. The results showed that the control group recorded higher score ($Rank-Sum = 7946.5$) when compared to the experimental group ($Rank-Sum = 7723.5$), but the difference of the scores was not significant for Q2. The results suggested that the learners struggled to understand the effect of the parameters of transformed hyperbolic functions.

The data after the intervention in the post-test indicated a statistically significant difference between the two study groups ($p - value = 0.0009$), less than $p - value 0.05$ at a 95% confidence limit. The experimental group has recorded a higher score ($Rank-Sum = 12628.5$) as compared to the controlled group ($Rank-Sum = 9327.5$), which had shown an improvement on understanding the effect of the parameters of transformed hyperbolic functions.

Focus Group Interviews Data

The interview data showed that most of the learners were able to explain what hyperbola graph is with their parameters. Furthermore, the data showed that learners had more of an understanding of drawing hyperbola graphs of given symbolic equations than the transformed functions. However, a lack of understanding and analysis of transformed functions prior the intervention was uncovered. The responses showed that learners had difficulties in finding the equations of the transformed functions and also giving the parameters $a, q, x -$ and $y - intercepts$ to draw a new graph. Extract 1 below is a sample from one of the focus group interviews conducted after the intervention in the experimental group.

...We only know how to draw graphs by using points. We calculate the points in a table and match them in the table as $x - values$ and $y - values$ and then draw the graph.

This extract depicts that learners displayed a limited understanding of hyperbola graphs as only knew table method to draw the graphs. Mulaudzi et al. (2016) argue that learners' plotting of hyperbolic graphs appears to be laborious and time-consuming. This could have been caused by the teaching approached used by the teachers.

The results revealed that there were benefits to the learners when the teachers used a transformation approach to teaching hyperbolic functions (Ada & Hurtulus 2010; Seago et al. 2012). The results revealed that learners understood how the hyperbolic functions translated either upwards or downwards and also how those graphs reflected either about the $x - axis$ or $y - axis$ (Ada & Hurtulus, 2010). Learner 12, cited verbatim, was one of the learners who participated in the interviews after having written the post-test (see Extract 2 below).

...No Sir, I learned them separately, because I just used points and intercepts to

draw the graphs. We were never taught how they are related before, and this made us to find it difficult to analyse these graphs. I am now able to know how to determine the equation when we are given a graph that is either translated or reflected.

The text in Extract 2 serves as an example that learners understood the relationship of the translated hyperbolic functions. It shows that this learner developed skills in analysing and interpreting the translation of the function $f(x) = \frac{a}{x}$ vertically upwards (Ada & Hurtulus 2010; Mulaudzi et al. 2016). The text suggests that the approach normally used by the teacher in Learner 12's school was ineffective, as learners thought each function was isolated from other functions. This learner indicated that after being taught to use a transformation approach, she was able to translate and determine the equation of the translated function. Her responses to the interview showed that the transformation approach was effective, as it made the hyperbolic functions easier for her to analyse and interpret. However, some of the learners still did not perform well in the transformation of hyperbolic functions.

Discussion of findings

The results prior the intervention showed learners demonstrating an understanding and analysis of hyperbola function in Q1 for both two groups. Though the control group had scored better than experimental group, there was no significant difference between the two groups. This showed that the learners could understand, analyse and execute (Polya, 1973) the given problems based on hyperbola functions. Learners could have been used table methods to successfully draw the given graphs.

As the intervention was implemented in the experimental group, learners' performance had improved in this group, as they were able to find the equations and draw hyperbolic functions. A transformation approach had benefits for the learners in the experimental group, as they improved in answering question items involving the transformation of hyperbolic functions. Seago, Nikula, Matassa, and Jacobs (2012) supported the benefits of using the transformation approach in teaching functions in the studies.

The experimental group had higher scores in both Q1 and Q2 than the control group after the intervention. Though the experimental group score higher than the control group, only Q2 showed to have a significant difference with the $p - value = 0.0009$. The experimental group showed that they had gained knowledge in understanding, analysing and executing Q2 problems, which are the first three steps in Polya's (1973) problem-solving approach.

The focus group interviews before the intervention revealed that learners in the experimental group were able to draw hyperbolic functions without properly understanding and analysing those functions, as suggested in the first two steps described by Polya (1973). The approaches that the teachers use to teach hyperbolic functions paid less attention to understanding and analysis, which are regarded as traditional approaches focusing on paper and pencil (Tarmizi et al. 2010). One of the learners said "*this discourages us*", suggesting that the pencil-and-paper method develops negative attitudes and is time-consuming for the learners, as indicated in the work of other researchers (e.g. Mulaudzi et al. 2016).

The focus group interviews after the intervention revealed that learners now understood the roles of a, x and q in the equation $f(x) = \frac{a}{x} \pm q$, which is regarded as understanding and analysing the problem (cf. Polya 1973). The learners found the use of the transformation

approach by their teachers beneficial, as they were able to understand and analyse hyperbolic functions as a result (Ada & Hurtulus 2010; Seago et al. 2012). Learners found the transformation of hyperbolic functions interesting, as they were able to understand how to find the equation and draw the transformed graphs. The results support the literature, as learners were able to demonstrate the skills of translated and reflected functions (Portnoy et al. 2006; Yanik 2011). The focus group interviews supported the learners' performance in the post-test, as they were able to find the equations and draw the translated graphs.

The intervention appeared to have had a positive effect on learners' learning of hyperbola functions (Ada & Hurtulus 2010). Learners in the experimental group performed better as compared to those in the control group in the transformation of functions in the post-test. The results revealed that learners in the experimental group gained knowledge of analysing and interpreting the translated and reflected functions in order to draw their graphs and determine the equations of those graphs (Polya 1973). Learners' interviews support the effectiveness of the transformation approach, as learners' performance had improved in solving problems related to the transformation of functions.

Conclusion

This paper concentrated on the effect on Grade 10 academic achievement of transformation approach used by five mathematics teachers teaching hyperbola functions if have improved or not. The findings of the study were analysed comparing the performance of the ten schools, control and experimental groups when learners solve hyperbola function problems. The two groups did not show any significant difference in the pre-test, but the experimental group performed better as compared to control group in both the post-test results which could have been effected by transformation approach used in this study. The study suggests that transformation approach can be used in other schools to see if it could yield same results as in this study.

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GO-GA: CLASS EXPERIENCES WITH INQUIRY LEARNING SPACES IN GO-LAB

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Abstract

The GO-GA project was initiated to improve Science, Technology, Engineering and Mathematics (STEM) education in Kenya, Nigeria and the Republic of Benin. The rationale is to implement contextually engaging digital STEM education in Africa through the Go-Lab ecosystem. First the digital platform was adapted to meet teachers' needs, such as the option to change the language (French, Swahili). Then teachers were familiarized with Inquiry Based Learning (IBL), and trained to develop an Inquiry Learning Space (ILS), a personalized learning environment for students, on the Go-Lab ecosystem. Teachers subsequently implemented this ILS in class. This study reports a pilot in which 55 teachers implemented ILSs in 44 schools, involving 1600 students. The overall research question was how ILS class implementation went. Online questionnaires for teachers and students were used to capture implementation. Two major challenges were anticipated: a pedagogical challenge, as the IBL methodology was new to the teachers and the students, and a technical challenge as class use presupposes sufficient computers and a stable internet. Our results do show technological challenges: slow internet, a limited number of devices (computers, laptops), and students with limited computer knowledge. The pedagogical challenges were less pronounced than expected: most teachers reported to understand IBL, and most students indicated that collaboration in the group went well. Almost 90% of the teachers were satisfied, and more than 90% of the students were satisfied and enjoyed the lesson. As a result of this study, recommendations for teacher training and for teacher support were made. However, the most important recommendation was to develop an app that facilitates offline use of an ILS. Schools would then no longer need an internet connection for students to work on an ILS.

Keywords: *STEM education; digital learning environment; Go-Lab; Inquiry Learning*

Introduction

Science and technology is becoming increasingly important in our society. To learn about science and technology is therefore essential for today's students. At a student personal level, this helps them to participate as informed members in society, and the scientific ways of thinking and scientific skills help them in making personal decisions based on evidence. At societal level it will help to cater for sufficient, well-educated practitioners in these areas. Hence there is a compelling need for appropriate Science, Technology, Engineering, and Mathematics (STEM) education, also at secondary school level (Bybee, 2013; De Meester et al., 2020).

In order to stimulate deep conceptual learning, Inquiry Based Learning (IBL) in which students engage in the scientific process, is often used in STEM education (National Academies of Sciences, and Medicine, 2019). The introduction of IBL in Africa faces a number of challenges. The lack of laboratories and science equipment in schools, and insufficient trained teachers to use IBL, are two of the main barriers. One possible way to

overcome the first barrier is to replace (part of) the hands-on labs by virtual ones in a digital environment.

So the aim of this study is to establish whether it is possible to educate teachers to use IBL in class, train them to develop an ILS in the Go-Lab ecosystem, and evaluate class use of the ILS. This paper recounts the outcomes of class implementation of digital labs and simulations in the GO-Lab ecosystem in secondary schools in three African countries: Kenya, Nigeria and the Republic of Benin. Class practice, student and teacher satisfaction, as well as pedagogical and technical issues will be reported.

Conceptual framework

Inquiry Based Learning (IBL)

IBL is a specific form of engaged or active learning (de Jong, 2019; Pedaste et al., 2015). In engaged learning students perform meaningful activities with the content offered, and go beyond the information that is offered to them (Freeman et al., 2014). In IBL, students are presented a scientific question and by performing investigations or collecting data, they are going to find an answer to this question. Based on the results of the investigations, students infer what this means for the subject domain (Xenofontos, Hovardas, Zacharia, & de Jong, 2020). In traditional teaching students often confirm knowledge, in IBL students construct meaning. IBL proved not effective when the entire process was left to the students (de Jong, 2019); students needed to be given the appropriate level of control (Lazonder & Harmsen, 2016). Finding the right balance between student and teacher (system) control is not simple (Bevins & Price, 2016) as this balance depends heavily on the educational culture (National Academies of Sciences, Medicine, 2018): what are students used to, what competences do the students have, and what expertise do the teachers have. Analysis of the PISA data has shown that the more open forms of IBL led to a more positive attitude towards science, and an increased interest and enjoyment in science. The more closed teacher-led forms of IBL led to higher knowledge scores (Cairns & Areepattamannil, 2019). The authors of the last study call for addressing each of the different domains (conceptual, epistemic, social, and procedural), and to allow for an appropriate level of guidance of students (see also the work of Kirschner, Sweller, & Clark (2006) explaining why minimal guidance does not work).

Lab work, virtual labs and Go-Lab

Lab work is quite common in the natural sciences. Furtak and Penuel (2019) argue that students “should engage in scientific inquiry, but with the priority of embedding those experiences in iterative cycles that will lead to the explanation of phenomena “. Osborne (2019) emphasises the “minds on” aspect, and stresses argue and critique activities as indispensable for scientists and engineers.

There is vast evidence that student learning outcome using non-traditional laboratories (virtual and remote) is at least equal to those using traditional labs (hands-on) (Dalgarno, Bishop, Adlong, & Bedgood, 2009; Gambari, Obielodan, & Kawu, 2017; Rowe, Koban, Davidoff, & Thompson, 2018; Rutten, van Joolingen, & van der Veen, 2012). Brinson (2015) carried out a comprehensive review of empirical studies comparing learning outcome achievement using traditional hands-on labs and non-traditional virtual and remote labs, and found that student achievement across all outcome categories (Brinson distinguished: knowledge and understanding, inquiry skills, practical skills, perception, analytical skills, and social and scientific communication) is equal to or higher in non-traditional labs.

Virtual labs have a number of advantages over hands-on labs: they are cheaper as no labs or equipment is required, have less environmental impact (no waste), students have unlimited access and can easily repeat experiments.

Combining virtual and remote labs with IBL has resulted in the Go-Lab ecosystem (www.golabz.eu). Digital labs from different repositories (such as the PhET labs, Amrita, Molecular Workbench, ChemCollective) have been brought together on this platform. However, this platform is not just a collection of labs, but it also houses a collection of apps and so called Inquiry Learning Spaces (ILSs) developed by teachers. An app is a small software tool that can help students in their inquiry process, such as a ‘Hypothesis Scratchpad’ to assist students to formulate a hypothesis, or a ‘Table Tool’ to assist in organizing experimental data (<https://www.golabz.eu/apps>). An ILS is a personalized learning environment for students, including a lab, apps, and other multimedia material (such as videos, images, external links, and articles). An ILS follows an inquiry cycle. The default Go-Lab inquiry cycle comprises of the following phases: orientation, conceptualization, investigation, conclusion, and discussion (Pedaste et al., 2015). In Kenya the 5E phases are used: engage, explore, explain, elaborate, evaluate. These phases are in line with the teaching approach adopted in Kenya. Teachers can configure the inquiry cycle they want to use to their own needs in Go-Lab. ILSs are developed and peer-reviewed by teachers. They know their students’ needs and interests, and understand the educational culture at school. When developing an ILS, teachers can start from scratch with an empty ILS, from a lab from the Go-Lab lab repository, or they can copy an existing ILS from another teacher and modify this before using it with their students.

The teachers

Introducing Go-Lab in STEM education will affect the role of students and teachers in class. Teachers no longer transmit knowledge but engage students actively in learning science and mathematics. This requires teacher preparation before (van Uum, Peeters, & Verhoeff, 2019), and support during class implementation. To be successful, teachers need to acquire specific pedagogical content knowledge (PCK) (Shulman, 1986), which can be seen as an amalgam of content knowledge, pedagogical knowledge, knowledge of the curriculum, knowledge of the students, and knowledge of assessment practices (Gess-Newsome, 2015). To describe the way teachers integrate ICT skills into their teaching, Technological Pedagogical Content Knowledge (TPCK) has been introduced (Koehler & Mishra, 2013). A study conducted in Tanzania in 2018 by Mtebe & Raphael (2018) shows that teachers confidence level in TPCK is lower than that in Content Knowledge and Pedagogical Knowledge. Integrating ICT by teachers into their teaching pedagogies is not easy (Mwangi & Khatete, 2017).

The teachers involved in GO-GA need to learn what Inquiry Based Learning (IBL) is, how this relates to doing lab work, and the pedagogies that can be used to actually teach in the IBL spirit. And on top this, teachers also need to become familiar with the Go-Lab digital ecosystem (de Jong, Sotiriou, & Gillet, 2014) in order to develop the ILSs they are going to use with their students. Successful class implementation further requires a proper digital infrastructure at school: sufficient computers or laptops for class use. As teachers in class use routine actions, changing these is complicated (Schön, 1983) and teachers will first need to unlearn their previous “repertoire”. So, it is not surprising that even after teacher preparation, there might be some hesitation from the side of the teachers to bring their newly developed knowledge and skills into the actual classroom practice. Preparing teachers is therefore seen as a process, not just an event (Fullan, 2007), it takes time. Different models have been developed to visualize such complex teacher learning (Clarke & Hollingsworth, 2002;

Coenders & Terlouw, 2015), and these models also apply to learning how to deal with inquiry learning in a digital environment.

Context of the study

This paper reports the findings of a pilot in which teachers in Kenya, Nigeria and the Republic of Benin, implemented an inquiry learning space (ILS) using the Go-Lab platform in their classes. Teachers participated voluntarily. Only teachers who had internet at school were invited to join this pilot. Before class implementation the teachers received training: first a three-day introductory course in IBL, and then a three day course about developing an ILS using the Go-Lab ecosystem. Most teachers implemented the ILS they had developed themselves in class at their school. Some however used an ILS developed by a colleague. During implementation, teachers were supported through a Teacher Implementation Manual (TIM), an online helpdesk (chat), e-mail, and a WhatsApp group in which teachers and support staff could easily communicate. The concise 37 pages TIM consisted of six chapters, partly giving practical “how to” advice and partly background information about IBL and suitable pedagogies for IBL.

In this pilot, technical and pedagogical challenges were anticipated. The technical challenges were related to the schools’ infrastructure, such as the availability of computers and of a proper internet connection. The pedagogical challenges incorporated how the teachers implement the ILS in class, and how students react to it. The following research questions guided this study:

- How does ILS class use in each of the three pilot countries look like?
- How do teachers assess their preparedness for and satisfaction about class use?
- How do students assess their learning and satisfaction about working on an ILS?
- What pedagogical and what technical issues emerged during class use?

Research method

Participants and design

In this pilot 55 teachers from 44 different schools taught 61 ILS classes. In each country (Kenya, Nigeria, the Republic of Benin) the pilot started with an official launch. The objective of this research was to capture class use, so we did not utilize a quasi-experimental design but evaluated what happened in each class (Corbin & Strauss, 2008).

Instruments

Online questionnaires were used to capture what had happened, and how students and teachers perceived this new way of teaching and learning. The student questionnaire consisted of 10 open and 13 closed questions. Most student questionnaires were completed by the group of students who had collaborated on the ILS. As the number of questions for the teachers was rather high, it was decided to divide these over two separate online forms: one with factual questions, having one open and 17 closed questions, and one for teachers’ experiences, seven open and 16 closed questions.

Analysis. A total of 55 teacher questionnaires, and 398 student-group questionnaires were analyzed. The answers were clustered to match the research questions. In order to make sense of the open questions, grounded theory principles were used (Corbin & Strauss, 2008; Gibbs, 2018): we did not define categories beforehand, but these emerged when reading the different answers.

Results

For each of the research questions the results will be presented below.
How does ILS class use in each of the three pilot countries look like?

Table 1 shows the most prominent results for class use. All data were reported by the teachers, by the students, or by both.

Table 1. General data about ILS class use

	Kenya	Nigeria	Benin
Number of teachers	23	15	17
Number of female students	459	211	175
Number of male students	383	108	265
Number of students per device (computer or laptop)	1-4: 43,4% 5-6: 26% > 6: 17,4% whole class: 4,3%	1-4: 95% 5-6: - > 6: 5% whole class: 0%	1-4: 29,5% 5-6: 47,0% > 6: 17,6% whole class: 5,9%
Improvement suggestions from students	Stronger internet More computers More time More videos, images, notes in ILS	Stronger internet More computers More videos, images	We received very few suggestions, some: stronger internet no English

The Table shows remarkable differences between the countries. Especially when it comes to the available number of devices it is clear that in Nigeria schools are quite well equipped, but on the other hand Benin needs to invest in devices.

Almost all respondents suggest to invest in stronger and faster internet.

How do teachers assess their preparedness for and satisfaction about class use?

All data in Table 2 below were reported by the teachers.

Table 2. Teacher responses about ILS class use

	Kenya	Nigeria	Benin
Teacher satisfaction	81,8% satisfied	89,5% satisfied	93,3% satisfied
How prepared for class use did the teacher feel?	Well: 86,4% Neutral: 9,1% Not well: 4,5%	Well: 79,4% Neutral: 15,3% Not well: 5,3%	Well: 93,3% Neutral: 6,7% Not well: -
ILS development? from scratch with a colleague copied and modified used existing one	: 65,2% : 26,1% : 8,7% : -	: 50% : - : 20% : 30%	: 52,9% : 5,9% : 5,9% : 35,3%
Did the teacher understand the Inquiry Learning methodology?	Well: 91,0% Neutral: 4,5% Not well: 4,5%	Well: 84,2% Neutral: 5,3% Not well: 10,5%	Well: 93,3% Neutral: 6,7% Not well: -

We also asked the teachers what support structures they had used during the pilot. Available were the Teacher Implementation Manual (TIM), WhatsApp group, e-mail, and online chat. Most teachers mentioned to having used only one of these, and not even often. The TIM was used most in each of the countries, followed by the WhatsApp group and then the online chat. The TIM was distributed as a paper version, so even without an internet connected teachers could consult it. The WhatsApp app ran on the teachers' private mobile phones.

How do students assess their learning and satisfaction about working on an ILS?

Most of the questions about student learning and satisfaction were posed to both the students as well as to the teachers. As the answers do not always align, in the following table, Table 4, the answers from both groups will be shown. For example, on the first question about how satisfied the students were with the lesson, the students answered and also the teachers responded how they assessed student satisfaction.

Table 3. Student and teacher responses about ILS class use

	Kenya	Nigeria	Benin
Student satisfaction (student replies) (and according to the teacher)	95,3% satisfied 96 % satisfied	96.9% satisfied 99,9% satisfied	88,9% satisfied 100% satisfied
Home internet use for study (student replies) (and according to the teacher)	Often: 32,9% Sometimes: 47,7% Not: 19,4% Use it: 30,4% Not use it: 43,5% Unknown: 26,1%	Often: 49% Sometimes: 37,7% Not: 13,3% Use it: 75% Not use it: 10% Unknown: 15%	Often: 22,2% Sometimes: 46,3% Not: 31,5% Use it: 5,9% Not use it: 35,3% Unknown: 58,8%
Computer knowledge (student replies) (and according to the teacher)	Enough: 84% Insufficient: 16% Enough: 27,3% Insufficient: 72,7%	Enough: 83,7% Insufficient: 16,3% Enough: 42,1% Insufficient: 57,9%	Enough: 55,6% Insufficient: 44,4% Enough: 20% Insufficient: 80%
Mostly liked in class (students)	The lab: 24% The video: 21% Other answers: 55%	The lab: 35% The video: 24% Other answers: 41%	The lab: 39% Learning content: 19% Other answers: 42%

Overall it is clear that both teachers as their students were quite satisfied about the ILS lesson. We noticed a larger discrepancy between student and teacher answers when it comes to having sufficient computer knowledge, the students rated this much higher than their teachers.

The students were also asked to indicate what they had learned in this lesson. This resulted in a large number of student answers. These could be categorized as (between brackets the average percentages of the three countries):

Specific content matter (62%)
Easier to understand (19%)

Computer/internet use	(17%)
Interesting to learn and more efficient	(7%)
Other	(4%)

Some examples of student on the question “what did you learn from this lesson?” are:

Effects of temperature and light on the state of photosynthesis.

It’s easier to understand the concepts.

That computers are the best learning gadgets and should be open to all students to familiarize themselves with it.

It is interesting and makes work easier since the teacher does not have to write on the board thus the student understands.

I learned to experiment.

What pedagogical and technical issues emerged during class use?

Pedagogical issues

The focus here was on what happened in class: what did the teachers do when the students worked the ILS and how was the student collaboration. The last question was posed to both the students as the teacher. In Table 4 these data are reported.

Table 4. Pedagogical issues according to teachers and students about ILS class use

	Kenya	Nigeria	Benin
What did the teacher do in class?			
monitor groups:	37%	19%	25%
answer group questions:	30%	26%	25%
explain procedure to whole class:	23%	37%	27%
explain content to whole class:	7%	15%	23%
other:	3%	3%	0
How was student collaboration? (student replies)			
well:	90,0%	92,9%	88,9%
neutral:	5,9%	3,1%	7,4%
not well:	4,1%	4,0%	3,7%
(and according to the teacher)			
well:	77,1%	84,2%	80,0%
neutral:	9,3%	5,3%	6,7%
not well:	13,6%	10,5%	13,3%

Here we noticed that students rate their collaboration higher than their teachers. In this category we also asked for ‘normal class’ practice with respect to doing assignments and doing practical work in the school science laboratories. Doing assignments for the STEM subject seems common, in all countries 90% of the students said to have at least regular assignments to do. Practical work varied: in Kenya 95% of the students said to have at least regular practical work, in Benin this is 60%, and in Nigeria 90%. So working on assignments is rather normal for students, they should therefore not have problems working on the assignments in the ILS. Most students also have experience with practical work, though less in Benin, so the use of the lab in the ILS is not an unfamiliar activity.

Technical issues

When a digital platform is used, that requires an internet connection, technical issues are expected. We were interested about the devices that could be used, how the internet connection is perceived, and what technical problems might have popped up. Table 5 below shows a summary of the results. All data are from the teachers.

Table 5. Technical issues during ILS class use

	Kenya	Nigeria	Benin
What devices were used?			
Desktop computers	35,2%	25%	6,3%
Laptops	47,8%	50%	84,2%
Tablets	6,5%	12,5%	none
Smartphones	10,5%	12,5%	9,5%
How is the internet connection perceived? Pages loaded:			
Quickly	none	25%	41,2%
Well	26,1%	15%	35,3%
Neutral	34,8%	35%	none
Slow	34,7%	5%	11,7%
Very slow	4,4%	20%	11,8%
How many teachers experienced technical problems?	54,5%	74,7%	66,7 %
What problems?	Slow internet	Slow internet	Slow internet Power supply

It is clear from these data that the number of devices varied across the countries, and that slow internet is one of the major technical challenges.

One advantage of using a digital environment on the internet is that all student answers are automatically recorded and can be assessed. In order to get an impression of student answers we copied and examined the work of four randomly chosen student groups in four ILSs. We noticed:

That student groups were able to work on an ILS successfully.

That time constraint was a serious factor for not finishing in one class period. Slow internet might be the reason for this. That some assignments or exercises were skipped (no answers were given at all). We do not know whether this was because of time constraints or because the students could not have an answer. That it is not possible to conclude what students exactly had learned, as we did not assess their initial knowledge. But we could see that all groups had performed an experiment and recorded experimental data.

Conclusion

Go-Lab can be successfully used for STEM education in Kenya, Nigeria and the Republic of Benin. The results from 55 teachers who have used an ILS in their classes, and their 1601 students (845 female and 756 male) evidently show this. The number of available devices (desktops, laptops) in schools needs to increase when we want students to collaborate effectively. Ideally would be two or three students per computer. Up to four students per device is workable, and this target is almost reached in Nigeria (95%), but neither in Kenya (43%) nor in Benin (30%). This low number of devices in combination with the experienced

slow internet makes it understandable that many students and teachers recommend investing in computers and in a faster internet connection.

Teachers were in general quite satisfied with the ILS lesson. Teachers also felt well enough prepared for class implementation. Quite a number of teachers used an ILS developed by or with a colleague. Teachers indicated to understand the IBL methodology well. This means that the teacher preparation programs have been successful. Students were also satisfied and happy about this ILS lesson, and this was confirmed by their teachers. Students do use internet at home for school purposes, but the percentages are still rather low, less than 50% of the students use internet often. Computer knowledge is rated high by students themselves, but teachers differ in this respect. There might be a need to teach specific computer skills before ILS use. That students liked the lab most in the ILS is encouraging, as this means that they like doing experiments.

The fact that quite a few teachers had to explain content to the whole class is remarkable. This could mean that there is a discrepancy between initial students' knowledge and what teachers assumed this knowledge to be when the teachers developed the ILS for class use. It is interesting to see that 90% of the students responded that their collaboration went well, teachers however rated this about 10% lower.

Recommendations

Our conclusions resulted in a number of recommendations for the next pilot. As slow internet is a big issues, an *offline* option will be developed so that at school no internet connection is required. Teachers develop the ILS *online*, subsequently download this ILS in the application for *offline* use, and then use it with their students in class *offline*.

Most of the recommendations resulting from this pilot were geared to strengthen teacher training. One of these is to use the Teacher Implementation Manual throughout the training so that teachers know where to find what kind of information. Others are about specific elements in an ILS, such as: because the lab is at the heart of an ILS, write clear and concise student instructions for manipulating the lab, and for data recording; do not use long explanatory texts; avoid long introductory videos; take the prerequisite knowledge into account. And maybe most important: have the students reflect on the content and on the process. This can be done in the lesson immediately following the ILS lesson.

Limitations

It is important to bear in mind that the presented data were self-reported by the teachers and the students. We did not do class observations nor a pre- or post-knowledge test. Another important aspect is that only teachers who had internet at school could participate. It is most likely that these schools also have a larger number of computers than schools without internet.

Our next pilot, where teachers can use the *offline* functionality, will show what the situation is in schools where internet is not available.

However, we have noticed that even with only *one* working computer plus a projector, an ILS lesson can be very effective, that is also an outcome of this pilot.

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EFFECTIVE TEACHING OF INFORMATION TECHNOLOGY FOR MEANINGFUL CHANGE IN SECONDARY EDUCATION

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Abstract

The purpose of this research relates to the topic of developing a theoretical model for the effective teaching of Information Technology (IT) for meaningful change in secondary education. Other objectives include determining which teaching strategies and methods were being used in secondary schools to teach the various components of IT, which adjustments needed to be made with regard to the teaching strategies and methods of IT in secondary schools, and what the implications of these adjustments were for the training of IT teachers in South Africa. The use of direct and problem-based instruction, as well as discovery and cooperative learning, was explored theoretically towards developing such a model for the effective teaching of Information Technology, and then illustrated with practical examples. The empirical research was undertaken, mainly by using questionnaires, in order to determine how IT was being taught in the classroom. These questionnaires were composed based on a literature study and revised after a pilot test. The empirical research found that demonstrations, individualized teaching and lectures with practice were viewed by teachers as the most effective strategies for teaching IT. Learners found that they obtained the best results in IT when they researched parts of the work themselves. Class situations where the teacher showed learners how to do the work, and they then got the opportunity to practice the work, and learners that helped each other with their work, obtained results that were almost as good. The greatest need for training of teachers of the subject was in the areas of graphics, desktop publishing and communication skills, such as the internet. Some results obtained from the empirical research were also offered to the subject advisor and didactical trainers of the subject for comment: there are courses available for teachers to better train themselves in order to teach IT effectively.

Keywords: *Effective Teaching, Information Technology, Change, Education*

1. Introduction

Things like the development of heuristics to make the evaluation of mobile e-commerce applications more usable seem to have become part of our everyday lives these days (Ajibola & Goosen, 2017). Educational technologies are also used more and more for growing innovative e-schools in the 21st century (Goosen, 2015a), with, for example, trans-disciplinary approaches to action research (Goosen, 2018a), and often in the form of a community engagement project and/or in the context of Information and Communications Technology for Development (ICT4D). The combination of information systems and technologies and research on technology-supported teaching and learning is also e.g. opening new worlds for learning to children with autism spectrum disorders (Goosen, 2019a).

When “instruction is taken beyond establishing facts and practising skills to an approach using more openness, investigation, problem solving and critical discussion, there will be more emphasis upon shared interpretation and evaluation of what goes on in” classrooms (Nickson, 1992, p. 105).

2. Purpose/objectives of the paper

The **purpose** of this research was to achieve **objectives** related to:

- developing a theoretical model for the teaching of Information Technology in secondary schools,
- determining which teaching strategies and methods were being used in secondary schools to teach the various components of Information Technology,
- which adjustments needed to be made with regard to choosing the ‘best’ teaching strategies and methods for first programming languages and Information Technology in secondary schools, and
- what the implications of these adjustments were for the training of Information Technology teachers.

2.1 Research questions

This research was undertaken to answer the following research questions:

- How could a theoretical model be developed for teaching Information Technology in secondary schools?
- Which teaching strategies and methods were being used in secondary schools to teach the various components of Information Technology?
- Which adjustments needed to be made with regard to the teaching strategies and methods for Information Technology in secondary schools?
- What were the implications of these adjustments for the training of Information Technology teachers?

3. Conceptual/theoretical background or framework

In terms of a framework for partnerships promoting the continued support of schools (Vorster & Goosen, 2017), the use of direct and problem-based instruction, as well as discovery and cooperative learning (Estes, Mintz, & Gunter, 2011), was explored theoretically towards the development of a model for the effective teaching of Information Technology, consisting of the following components:

1. Planning
2. The use of IT textbooks in teaching and learning
3. The handling of new information from the computer field
4. Programming
5. Problem solving
6. Feedback from learners.

This model will now be further illustrated with practical examples.

3.1 Planning

The departure point for education is that which learners should be able to do, that they could not do previously, after they had been exposed to a certain learning situation (Monau, 1997).

3.1.1 *Conceptual development*

Although the integration of different themes is important, the teacher should also think about types of activities and what to teach, by organizing concepts carefully.

3.1.2 *Role of outcomes*

Both short and longer-term outcomes should be considered when compiling a profile of each learner with regard to general computer competence, as well as specific areas where learners already show competence – this should also be done in a non-intimidating way and individualised as far as possible. Learners can further discuss with small group of their peers

what each of them want to achieve with the subject Information Technology. Learners therefore not only develop explicit goals, but a class climate of mutual respect is also built.

3.1.3 What do learners bring to the computer class?

The learning of Information Technology definitely occurs within the context of the computer knowledge that learners build in their immediate environment - at home, at the internet-café, or for example, by making use of the information systems architecture supplied by the government or other enterprise information technologies at a regulatory institution, made available to the community.

They bring certain competencies, knowledge and views to the classroom and this will influence how they make sense of new knowledge. Knowledge is more accessible, and will therefore more likely be transferred to new situations, when it forms a central and integral part of a person's cognitive structure

3.1.4 Interconnectedness of knowledge

There should be interaction between learners and new knowledge, and interaction amongst the learners themselves. Learners should be provided with the opportunity to give meaning to the new knowledge, connect it to their existing knowledge and to test their comprehension thereof against other meanings, while they are also exposed to a number of different viewpoints.

It is especially important when topics, which learners are required to understand, are presented, that the teacher keeps on checking learners' understanding. In general, it is important during planning to ensure that the objectives for the lesson, as well as the procedures required to ensure that these were achieved, are set out well.

3.1.5 Active learning using metacognition

Metacognition refers to learners' awareness and knowledge of their own cognitive processes, their associated products, and how these are related to learning outcomes and the ability to evaluate and control the thought processes (Goosen, 1999). Learners should possess the metacognitive awareness and managing strategies to actively monitor and direct their own studies and problem solving.

3.1.6 Getting started

The start of an effective lesson consists of planning a learning activity, which will generate and support the discussion and doing of IT by learners (Sai, 1994). When an IT lesson is being planned, the special nature of the lesson topic and objectives, resources available, size of the class, time available and the developmental stage(s) of learners should be considered (Jacobs & Bezuidenhout, 1994). Planning the lesson sequence consists of:

- Determining what existing knowledge learners need to proceed with this specific lesson;
- How can be determined whether learners have this existing knowledge; and
- How the new topic can be introduced.

In an effective lesson, the teacher would typically set up a meaningful situation (for example, an activity for learner exploration), which generate and support learning activities amongst small groups of learners (Sai, 1994). In order to be effective, the situation should motivate learners, sustain learners' interest and involve learners in meaningfully talking about and engaging with learning content. Together with these, effective discussions should be used, which are based on an activity in which learners work together discuss what they are doing. It is also necessary to ensure that the teacher checks whether all learners understand the model used in the lesson and will be using that model when completing written exercises – the teacher could achieve this by modelling course-design characteristics, self-regulated learning

and the mediating effect of knowledge-sharing behaviour as drivers of learners' individual behaviour (Ngugi & Goosen, 2018).

3.1.7 Affective aspects

Goosen (1999) indicated that another approach that can be used profitably in the class is the intertwining of the affective aspects of a specific topic with the cognitive objectives of the lesson, so that affective level responses are provoked in learners as part of that class session (Friedland, 1992).

3.2 The use of Information Technology textbooks in teaching and learning

In general, IT textbooks act as a handy source of subject knowledge and can be used by learners for revision purposes (Jacobs & Bezuidenhout, 1994). With regard to the so-called 'theory' chapters, the teacher should explain clearly to learners what it is that they should be able to do at the end of each chapter: should they be able to compute sums similar to those in the chapter, or should they know definitions and be able to compare different computer generations? The questions that appear at the end of certain chapters could act to indicate the level of knowledge required, or the teacher could consider supplying learners with a list of questions at the required level. Especially in Grade 10, when learners are first getting to know the subject, it might be worth the while to introduce learners to specific learning techniques, which are applicable to certain chapters and provide them with opportunities to practice these. Experience shows that many learners, even at Grade 10 level, still do not have access to effective study techniques for learning.

3.3 Handling new information from the computer field

Especially chapters in IT textbooks on, for example, Information Systems architecture and technology security aspects relating to the usability attributes and evaluation methods of mobile commerce websites, quickly become outdated and it is essential that the teacher, together with the learners, aim to stay up to date with the latest trends with regard to the field. Newspaper and magazine articles, as well as information from the Internet, can be useful in this regard. These new pieces of information could be displayed on a notice board and be updated frequently, and learners can also use it in the completion of their research projects. When learners present their research projects to the class, other learners also get access to such information, while the teacher is provided with an additional way of ensuring that this is indeed the learner's own work.

3.4 Programming

3.4.1 Guided exploration

Despite strong indications to the contrary in favour of allowing learners to learn programming on their own, Mayer (1994) quoted educational researchers, who found that when learners work on their own in non-directive, hands-on teaching programs, they are often not successful in the discovery of even the fundamentals of programming. In comparison, teaching that emphasizes structure and mediated guidance, obtains better results for transmission and learning. Structuring ensures that the learner receives the basic information in a useful order, while the mediation of the teacher ensures that the learner connects the presented information with relevant existing knowledge. The overwhelming consensus is that, for most learners, a practical discovery environment should be complemented by instruction that emphasises structure, interventional facilitation by the teacher, and direct instruction in the programming language (Goosen, 1999).

Chapters in textbooks that are used in the learning of programming usually consist of:

- definitions and concept structures that have to be learned;
- sections that explain work like a teacher would;
- examples that learners work through themselves; and
- exercises that should be completed by learners (Jacobs & Bezuidenhout, 1994).

3.4.2 Teacher-learner conferences

The teacher could indicate to learners the programming assignments that should be completed, and then spends time with each learner to discuss her/his efforts; with special attention to two areas of competency and two areas where they can improve. Notes can also be made with regard to additional teaching needed and/or possible next assignments.

3.4.3 Portfolios and projects

Learners should be provided with opportunities to work on projects, research papers and group activities, instead of a mountain of summative tests. A ‘contract’ can be drawn up with regard to what is expected of the learner, and when it should be completed. Changes, extensions and flexibility should, however, be possible. There should also be no upper ceiling for what can be achieved, and learners should clearly understand that commitment and responsibility is expected.

3.4.4 Developing programming mastery

It should be indicated very clearly to learners that one can not only learn for programming tests and exams ‘the night before the time’, but that this type of knowledge is rather built up gradually, as the learner works on his own programs. It is therefore essential that each learner will write and debug her/his own programs. Learners should be thoroughly introduced to the debugging section of the programming environment and should use it regularly. However, where learners make logical errors, especially the teacher can help by explicitly explaining why the error occurred and how it can be rectified.

3.4.5 Memory picture of computer system

Learners’ ability to use a programming language to solve problems can be improved by using instruction methods that help the learner to build a memory picture of the computer system. Included in this is:

- a simplified version of the main areas where processing is carried out;
- the objects that operations are carried out on; and
- the actions that are executed within the computer.

3.5 Problem solving

3.5.1 Choosing a problem

To teach problem solving effectively, more should be done than just presenting learners with problems (Goosen, 1999). It is the task of the teacher, as ‘salesperson’ of knowledge, to convince learners that what the point being discussed, is interesting indeed and that the problem that they are trying to solve deserves their efforts (Polya, 1981). For these reasons, the teacher should pay attention to the choice, formulation and acceptable representation of the problem that (s)he wants to present. The problem should be meaningful in and relevant as is possible from the learner’s viewpoint, it should be related to the every-day world of the learner, and should be introduced using a paradox, a joke or any other situation that will draw learners’ attention. As an alternative, the teacher can start from information that are quite familiar to learners, and therefore has meaning to learners, or can be applied.

3.5.2 Learners’ contribution

If learners are allowed to actively contribute to the formulation of the problem that they are going to solve, they are not only motivated to work harder, but they also learn a meaningful attitude towards thinking (Polya, 1981).

3.5.3 *Opportunities for developing skills*

To ensure that an atmosphere is created in the learning process where learners can develop into problem solvers, it should be ensured that they get enough opportunities to:

- observe and discuss patterns;
- predict solutions;
- to experiment with ideas;
- to discuss and compare problem solving strategies;
- judge the progress that is being made in their own learning process; and
- to communicate what they already know, compared to those sections where they are still experiencing problems in the learning situation (Sai, 1994).

3.5.4 *Algorithms vs. problem solving*

The education of learners further requires that they should learn more than the simple application of standard algorithms in a restricted number of applications, but rather that they are enabled to act as genuine problem solvers in the real and cyber worlds.

3.6 Feedback from learners

Learners could benefit from listing the factors that prevent them from doing well, or better, in Information Technology, and then make suggestions of what they can do about these problems themselves (Birken, 1987). This aspect was addressed in the learner questionnaires (see later) and provided a lot of useful information, which can be useful to the teacher. Large improvements with regard to attitude, attendance, completion of assignments, and willingness to participate in class were observed for learners, who were requested to complete such a assignment.

4. Methods/ techniques

The empirical research was undertaken, mainly by using questionnaires, in order to determine how Information Technology was being taught in the classroom. These questionnaires were composed based on a literature study and revised after a small pilot test.

A case study was used to investigate how innovative educational technologies, technology-supported teaching and learning and research methods were being used by educators (Goosen, 2019b) to improve students' access to an ICT4D Massive Open Online Course (MOOC) (Goosen, 2018b) in the 21st century (Goosen, 2015b).

4.1 Research design

A descriptive study was designed to gather data, using questionnaires, aimed at teachers and learners of the subject.

4.2 Data collection instrument(s)

The questionnaires were designed by the researcher and initially piloted with a small number of teachers and learners, who did not form part of the population. The revised teacher instrument was distributed and completed at a two-day gathering of provincial teachers organized by the subject advisor at the time. A number of teachers, who did not attend, were sent a questionnaire and returned the completed ones. The revised learner instrument was distributed to the schools, which formed part of the population of this study.

The teacher questionnaire consisted of 75 items, divided into five sections, while those for learners were divided into four sections, two of which consisted of a total of 26 Likert scale multiple choice items with four riders each.

4.3 Sample/sampling technique

The research was limited to 42 secondary schools from the Western Cape province of South Africa, which offered Information Technology as subject at the time when the study was carried out. All IT teachers at these schools [N = 48] were involved, as well as the IT subject advisor and applicable subject didactical trainers of teachers in this province. Two high achievers and two low at each school were also invited to take part in a questionnaire survey [N = 168], with the sampling technique being targeted at obtaining a representative sample of the population.

4.4 Validity/reliability of instrument

In terms of validity, questionnaires and interview schedules were used to obtain data, without which the purpose of this study could not be achieved. One of the objectives of this study was to determine to which extent certain teaching strategies and methods were being used in secondary schools to teach the various components of IT. Items to establish this were therefore included in both the teacher and learner questionnaires.

With regard to the reliability of the instruments, an effort was made to conduct and report the research in such a way that other researchers repeating the research procedures would obtain similar results. Including objectivity, the questionnaires should, when repeated under similar circumstances, produce similar results.

4.5 Data analysis

Ethical data management and research integrity in the context of e-schools and community engagement, as also described in Goosen (2018c), was maintained with regard to data analysis activities. Inductive data analysis was applied to qualitative aspects, as the objectives and research questions related to understanding the class situation and aimed to expose results, which were not necessarily expected (Goosen, 1999). This is also more likely to help the researcher to “identify the multiple realities potentially present in the data” (Maree, 2020, p. 42).

5. Results/findings

The following reflects some of the results found in the empirical research carried out as part of the study reported on in this paper:

- More than a third of these teachers (15; 36%) had a Computer Science qualification at least second year level, but almost a quarter (24%) could not report such a qualification (see Table 1). Please note that no masters or doctoral levels were indicated.
- For almost two-thirds of these teachers, their highest professional qualification was a Higher Education Diploma (HDE), almost a quarter had a Further Diploma in Education (FDE), with another two, who had a Bachelor of Education (BEd) degree (see Table 2). Please note that no MEd or doctoral levels were indicated.
- Demonstrations, individualized teaching and lectures with practice were viewed by teachers as the most effective strategies for teaching IT (see Table 3).
- Learners found that they obtained the best results in IT when they researched parts of the work themselves. Class activities, where the teacher shows learners how to do the work, and they then get the opportunity to practice the work, and learners that help each other with their work, obtained results that are almost as good (see Table 4).

- The greatest need for training of teachers of the subject was in the areas of graphics, desktop publishing and communication skills, such as the Internet (see Figure 1).

Table 1: Teachers' highest qualification in Computer Science

Teachers' highest qualification in Computer Science	Number	Percentage
First year level	3	7%
Second year level	12	29%
Third year level	15	37%
Honours level	1	2%
Other	10	24%

5.1 Discussion

In terms of the theoretical instructional model approach developed (Estes, et al., 2011), the results showed that all of the teaching strategies and methods, which learners most prefer to be used in secondary schools, should contribute to learners' *conceptual development* (see 3.1.1); together with good **planning** (see 3.1) as set out in this proposed model (Maree, 2020), in terms of performing the required skills (Monau, 1997).

Table 2: Teachers' highest professional qualification

Teachers' highest professional qualification	Number	Percentage
HED	29	63%
FDE	10	22%
Bed	2	4%
Other	5	11%

Table 3: Averages and standard deviations regarding class activities

Class activity	Average	Standard deviation
Demonstrations	2.65	0.97
Individualized teaching	2.58	1.17
Lectures with practice	2.33	1.11

Table 4: Averages for class activities selected by different learner groups

Class activity	Above 80%	71% - 80%	51% - 70%	50% and below
Teacher shows how, then practice the work	1.44	0.75	0.62	0.58
Learners research parts of the work themselves	0.50	1.63	0.85	0.67
Learners help each other with their work	0.81	0.69	0.62	1.67

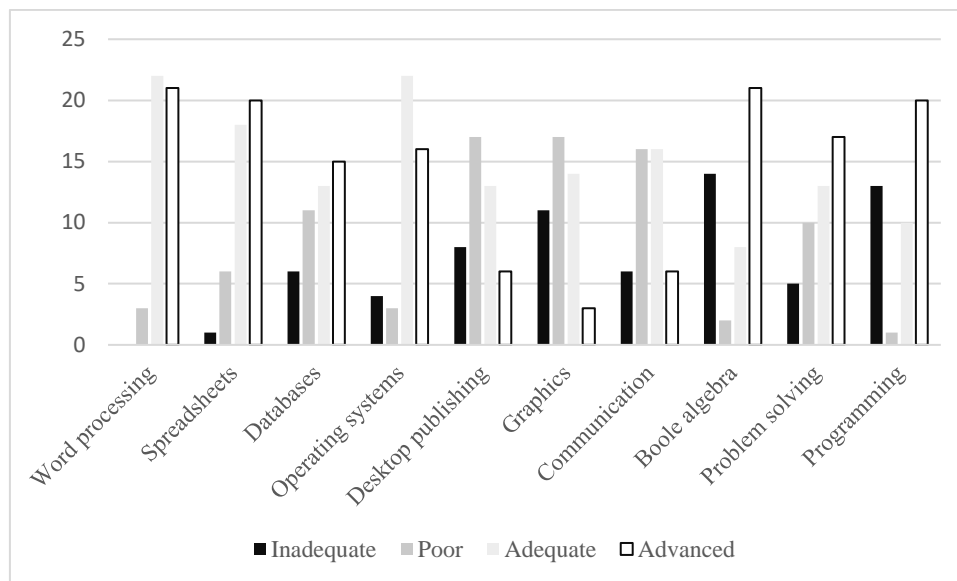


Figure 1: How IT teachers see their ability to teach different topics

With regard to practical guidelines and hints for the effective teaching of IT (Jacobs & Bezuidenhout, 1994), a class approach, where the teacher shows learners how to study the subject, e.g. as described regarding **the use of IT textbooks in teaching and learning** (see 3.2), and they then get the opportunity to practice the work, was one of the most popular choices relating to IT opening new worlds for learning (Goosen, 2019a).

Learners' 'favourite' class activity (see Table 4), research-supported methods (Goosen, 2019b) for going through parts of the work themselves, can be used productively for **handling new information from the computer field** (see 3.3).

Both the demonstrations and lectures with practice viewed by teachers as the most effective strategies and methods for learning and teaching IT (Mayer, 1994) provide for growing innovative learners (Goosen, 2015a) with the *guided exploration* (see 3.4.1) they need for computer **programming** (see 3.4).

Choosing a problem (see 3.5.1) that is applicable helps learners towards the discovery (Polya, 1981) they need for **problem solving** (see 3.5).

Feedback as had been obtained **from learners** (see 3.6) in this study contributes towards a classroom approach that teaches learners how to study the subject (Birken, 1987).

5.2 Implications

McEwen (1996) found that most educators in that study had little or no training in teaching IT. The study discussed in this paper discovered that although most teachers should be quite familiar with large sections of the academic content (see Table 1), there is a gap regarding their training relating to teaching and learning the subject (see Table 2). The implication would be that IT teachers should have access to, and participate in, training, which, in answer to the fourth and last research question, would enable them to implement adequate adjustments with regard to the teaching strategies and methods they use in secondary schools.

6. Conclusion

Based on the findings presented and discussed, it can be concluded that in terms of **originality** and a **contribution to the field**, this paper shows how sustainable and inclusive quality education can be made possible through research informed practice on Information Technology (Goosen, 2018d). Using Information and Communications Technologies (ICTs) to facilitate teaching and learning should also be considered, as both learners in Basic (schools) and students from Higher Education (Goosen, 2016) have indicated that they want such e-learning.

An appropriate **depth of research** was achieved by citing a wide variety of resources spanning more than two decades, including several seminal ones, but also incorporating a majority of recent sources, published within the last five years.

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FACTORS AFFECTING ISIXHOSA LEARNERS IN WRITING ENGLISH AS FIRST ADDITIONAL LANGUAGE IN RURAL PRIMARY SCHOOLS

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Abstract

The study focuses on factors affecting English writing proficiency of second language learners whose first language is isiXhosa. The rationale for this study is the view that learners struggle to write in English. The study was carried out in a rural area where the researchers used classroom observation and interviewed two Grade 6 teachers and 8 Grade 6 learners to gather the data. It is interpretive and is based on a case study. The study revealed limited proficiency in English First Additional Language (EFAL), resulting in learners having challenges in writing English as an additional language. However, teachers resorted to using their native language in place of English as the medium of instruction. This is because some learners feel more comfortable expressing their views in their mother tongue. The study concludes that more work still needs to be done in this area, especially in training teachers to be in a position to assist learners in the development of EFAL writing.

Keywords: English First Additional Language; writing; language proficiency; isiXhosa speaking learners; home language.

Introduction

South Africa is an example of a developing country in which the majority of the population speak indigenous languages as their home languages. It is in this context that the Language in Education Act 27 of 1997 section 3(4) assumes that learning more than one language should be the general practice in our society. In line with this, the Curriculum and Assessment Policy Statement (CAPS) of 2011 stipulates that learners in the Foundation Phase (FP) use Home Language (L1) as the Language of Learning and Teaching (LoLT), while simultaneously having a First Additional Language (FAL) as a subject. After that they switch to English as LoLT, with learners' L1 being studied as subject up to Grade 12 level (Probyn, 2005). This shift from mother-tongue instruction in the first three years of schooling to a second language (L2) in Grade 4 is problematic (Fleisch, 2008). These learners had a limited vocabulary of about 500 words and could only read simple 3–7-word sentences in the present tense (Fleisch, 2008). This study provides insights into what is taking place in the classroom concerning the impact of L1 in writing EFAL. It is the researchers' view that gaining such insights is likely to enhance teachers' choices in selecting teaching methods and strategies that will contribute to teaching of EFAL to develop writing in the target language.

Moreover, writing starts with learning to write letters of the alphabet and moves to words and then sentences. For learners to know how to write a paragraph, they must at least be able to put together words that construct a sentence. However, some of the isiXhosa learners in this study still have a challenge to write a word. According to Blease and Condy (2015), poor writing skills of learners have been associated mostly with teachers' lack of knowledge of effective writing approaches to support the development of writing constructively, especially among second language learners. Many teachers in EFAL classrooms have limited understanding of the writing approaches and as such, they use inappropriate writing strategies in their classrooms (Dornbrack & Atwood, 2019). This affects teachers' attitude towards the teaching of writing. This could be why Ngubane (2018) observes that very little writing practice takes place in EFAL classrooms. Thus, several studies have been carried out to

improve teaching writing to second language learners, but there is a dearth of literature focusing on factors affecting isiXhosa speaking learners in writing EFAL.

Research objective and questions

This study set out to give a picture and understanding of factors affecting isiXhosa speaking learners in writing EFAL in rural primary schools.

There are two research questions related to the main objective.

- What writing challenges do Grade 6 isiXhosa learners experience when writing in EFAL?
- What strategies are appropriate for the improvement of Grade 6 isiXhosa writing skills in EFAL?

Review of literature

English Language Learning and Teaching

Learning a language is a complex process where the development of grammar is only one part (Clark, 2003). For instance, isiXhosa has a relatively simple syllable structure, and unlike English, it allows more complex structures to be constructed (Hua, 2002). Moreover, isiXhosa has a fairly transparent, consistent, alphabetic orthography which is more amenable to sublexical processing, whereas the English has a deep orthography in which readers rely less on grapheme-to-phoneme representation and more so on whole-word processing (Probert & De Vos, 2016). This indicates that the acquisition of L2 is often viewed as a process that differs from native-language acquisition, and it is frequently assumed that factors influencing one's ability to acquire an L2 do not play a role in native-language development (Kaushanskaya, 2011). This may help to explain why the isiXhosa speaking learners struggle to write EFAL.

In coping with writing, code-switching cannot be overlooked, especially in a class where English is taught and learnt as an additional language. To bridge the communication and comprehension gaps, code-switching cannot be avoided in the classroom. It plays an important role in classroom interaction to enhance the positive contribution of the use of code-switching (Sert, 2005). The teachers' ability to interpret difficult concepts of learners' mother tongue is acknowledged by Clegg and Afitska (2010) who affirm that speakers switch to manipulate, influence or define the situation as they wish and to convey nuances of meaning and personal intention. Sert (2005) asserts that code-switching is an important element to language teaching because, if used effectively, it serves to bridge the gap between the known and the unknown. Clegg and Afitska (2010) point out that those who code-switch are fully competent in the two languages. They add that code-switching provides an additional resource for meeting classroom needs.

Writing Challenges Faced by English First Additional Language Speakers

Writing is highly complex; its importance in our society today cannot be overemphasised. Writing in L2 makes the task further complicated, as it requires sufficient command of the L2 to fulfil all the formalities, namely composing and developing logical ideas, which are essential for a written text to be comprehensible (Sarfraz, 2011). The results may be terrible because the pressure will affect L2 language learners in writing EFAL. Similarly, in this study learners do not have mastery of English and therefore experience challenges when writing in the FAL. Kern (2000) proposes that instruction offered to learners must consider their scholastic background, societal background and indigenous knowledge if it were to

make a difference in learners' lives. Physical conditions in and around the home do seem to play a role in learners' language challenges (Kern, 2000).

Home Language Interference with Writing English First Additional Language

It has been well established in the literature that language learners use the knowledge of their L1 when they learn to write in English L2. According to Huwari and Al-Shboul (2016), L1 interference is another challenge faced by ESL learners, and it is caused by the fact that they think in their language but they write in English. The results may be terrible because mother tongue word order and target language word order may be mismatched. Iqbal (2016) found that mother tongue interference in learning a language has the power to influence the acquisition of a target language negatively. In the context of this study, when learners apply L1 in writing EFAL, it affects the progress of writing in the target language. Unfortunately, such interference often causes the incorrect and incomprehensible meaning of the written texts. Among other scholars, Huwari and Al-Shboul (2016) argue that while it is beneficial to use the mother tongue when teaching ESL learners, the disadvantages of this practice outweigh the benefits. When L2 writers do not have enough language skills to express what they say in a comprehensible way, they have a greater possibility for errors at the morpho-syntactic level (Myles, 2002). Therefore, accurate and early identification of factors affecting isiXhosa speaking learners' writing proficiency in EFAL is essential for learners' prognosis.

Teachers' Language Proficiency and Attitude Towards Teaching EFAL

Teachers have to be knowledgeable in the language itself so that they can make a useful decision on how the teaching should be done. Literature indicates clearly that the teacher who sets the tone of learning activities (Quist, 2000). A study conducted by Chokwe (2013) revealed that having under-qualified teachers results in ineffective teaching of writing. Quist (2000) demonstrates that among the factors that lead to students' poor performance is the quality of teachers. Moreover, if early years at the school fail to provide the right foundation for learning, then no amount of special provision at later stages will be able to achieve the full potential of the child in terms of how his learning will proceed, and how beneficial his attitudes are towards his future life and learning (Quist, 2000). Criticism by English language teachers when marking learners' work can demotivate, and consequently, L2 learners lose self-esteem and hope of ever becoming good writers (Ellis, 2009).

Theoretical framework

The study is situated within two theoretical frameworks, namely Constructivism and the Socio-cultural perspective. The two theories acknowledge that learning takes place through social interaction and that language plays a significant role in shaping thoughts and in directing one's cognition in the process of learning (Santrock, 2008). In other words, learners need to be able to make sense of what they learn. Constructivism looks into how learners construct meaning on their own and how they relate new knowledge to prior knowledge and familiar contexts. This implies that isiXhosa speaking learners use L1 to learn about what they do not know in the EFAL. According to Amineh and Asl (2015), if the child has to deal with the situation that is not fully handled by the existing schemes, this may create a state of disequilibrium between what is understood and what is encountered. In the context of this study, the Constructivism Theory is important as it embraces learners' prior knowledge that should be acknowledged when teaching writing to EFAL learners.

The Sociocultural Theory sheds light on how social interaction plays a crucial part in the development of cognition (Amineh & Asl, 2015). This theory recognises the role of social interaction as people create knowledge and negotiate meaning for themselves in real-life

situations. At the same time, one gains the necessary language skills through interaction with the teacher and more skilled peers (Santrock, 2008). In other words, social collaboration is central to the teaching-learning process (Amineh & Asl, 2015). This theory regards the teacher as a facilitator in learning. In other words, opportunities for children to learn from the teacher or skilled peers are established through interaction and cooperative learning (Santrock, 2008; Amineh & Asl, 2015). In the context of this study, social interaction is the cornerstone of teaching writing of EFAL.

Methodology

Research Design

The study utilised a qualitative research approach, and a case study design was adopted (Cohen et al., 2007). This approach and design allowed the researchers to live with the participants and witness their lived experiences (Creswell, 2009).

Population of study

Participants of this study were carefully selected individuals who were experiencing the phenomenon of L1 effects on writing EFAL. The researchers selected two rural primary schools with isiXhosa speaking learners to find out the impact of L1 on EFAL writing. Given the qualitative nature of the study, the researchers selected participants that yielded the most information about the topic under investigation (Leedy & Ormrod, 2005).

Study sample

The study used purposive sampling to permit inquiry into and understanding of the phenomenon in depth (Leedy & Ormrod, 2005). A small sample of two Grade 6 classroom teachers (both females) and 8 Grade 6 learners (4 boys and 4 girls for observation and focus group interview) were selected purposively. The choice of two female teachers, one in each school, was because they were teaching EFAL at the time of the study. Both teachers were aged between 37 and 55, and their teaching experience ranged between 12 and 28 years. The ages of learners were between 12 and 13 years, who comprised four boys and four girls. In reporting the data, teachers were labelled as Tr-A and Tr-B and learners were labelled as Ln A- Ln H.

Instruments

The researchers collected data in the form of words through interviews, using interview guides and observations as instruments of data collection (Cohen et al., 2007). In observation, the data was gathered through a combination of field notes and audio/visual recordings. The trustworthiness of the research was ensured using the triangulation of data collection methods and the use of verbatim quotes from the participants' explanations of their experiences (Creswell, 2009).

Data analyses techniques

The central task during data analysis was to identify common themes in the participants' descriptions of the impact of L1 on writing L2. These themes were sent to the participants for comments in the process of member checking. Critical Discourse Analysis (CDA) was employed for the analysis of data in revealing the ideological loading of spoken and written discourses (Fairclough et al., 2011).

Findings

The data revealed a few interesting facts regarding the impacts of L1 in writing EFAL. It revealed that limited proficiency in EFAL results in learners having challenges to express

themselves and to comprehend through the language of instruction. Both teachers also indicated that learners become confused when learning EFAL, which resulted in unfinished work and activities.

Factors That Affect Learners' Writing Proficiency in EFAL

The major problem highlighted by the teachers who participated in the study was that learners tended to translate their L1 into EFAL. Tr-A indicated that learners relied on their L1 when they lacked elements (phonology, grammar, etc.) of the target language. She further said; “*for example, they write ‘Desember’ for ‘December’, ‘oranje’ for ‘orange’, and ‘notis bord’ for ‘notice board’.*” The researchers noted the same interference during observation. Some interference from English borrowed words was evident in portfolio activities in School B in which spelling of words were evidently influenced by L1. For example, ‘bucket’ was spelt ‘baket / ‘bhacket’, ‘brush’ was spelt ‘brutsh’ / ‘bratsh’ and ‘clean’ was spelt ‘klin’.

Findings from learners indicated various reasons like language interference (i.e. translation of L1 to EFAL), spelling errors, lack of parental involvement, poor proficiency in writing skills of EFAL and lack of self-confidence. For instance, when they were asked on challenges they encountered when writing in EFAL, the learners said:

Ln B: *Xa ndibhala iEnglish ngamanye amaxesha ndiyalibala ukulibhala igama kakuhle ndilibhale ngesiXhosa” (When I am writing in English, I sometimes forget to write the word in English and end up writing it in isiXhosa)”.*

Ln E: *“Ndiye ndixakwe kukulipela igama ndilipele ngerongo umisi andixhaxhe” (I struggle to spell words correctly and that results in the teacher marking me wrong).*

Ln F: *“Xa sinikwe homework mna andinamntu wokundincedisa njengotshomi bam; kaloku ootshomi bam bona bayancediswa ngosisi babo nobhuti babo. Mna ekhaya ndihlala nomakhulu wam ngoku akandincedisi ndingakwazi ukubhala kakuhle.” (When we are given homework, I do not get assistance like my friends do. My friends are helped by their siblings from home. I stay with my grandmother who does not assist me in writing, and that makes me write wrong answers).*

Ln G: *“Mna sometimes ndiye ndibhale ndicinge ukuba ndirongo kodwa xa ibuya incwadi yam ndibe right” (Sometimes I write thinking it is a wrong answer when my book comes back I discover that I was correct).*

Ln A: *“Xa ndingavanga uMiss ukuba uthi masibhale ntoni, ndiyoyika ukubuza, ndibhale into. Ndiyayeka ukubhala ndishiye izithuba kuba andiyazi into mandiyibhale” (I am afraid to ask when I miss the instructions. I just stop writing and leave blank spaces, because I do not know what needs to be written).*

Data revealed that spelling was one of the biggest challenges faced by learners with isiXhosa background. Their work had many grammatical errors, vowel omissions and insertions, letter transposition and consonant blending. Below is a table indicating target words and words with errors and spelling errors in the learners' writing.

Table 1: Words with spelling errors

Target word	Word with errors
Year	Here
Healthy	Helthy
Beautiful	Butiful

One interesting aspect observed during classroom observations was that in some instances learners were allowed to use their L1 when discussing or responding during the English period. Teachers supported this practice saying thus, *'we do not want to embarrass learners'*. Tr-B further asserted; *'That is why I code switch more often because I am developing their self-esteem'*. When she was asked to explain this assertion she said that she does not want a quiet language classroom, hence to assist learners *'I have to code switch for them to be comfortable in responding to questions'*. It is necessary to mention that some of the learners were so quiet because they were afraid of making mistakes. It is also evident that L1 influence is greatly affecting the acquisition of EFAL learning.

The teachers' level of training for teaching in the L2 seems to be a factor and challenge that impacts negatively on learners' language proficiency. For instance, one of the teachers was not trained to teach English but Mathematics and Sciences. She was teaching the subject because there was a shortage of English teachers.

Discussion of findings

Although translation in the learners' L1 was used to facilitate learning, the data revealed that it limited learners' exposure to English language input in the classroom. Thus, some of the learners ended up with very limited proficiency in English. The policy states that CAPS learners should achieve the same degree of proficiency in their L2 as they do in their L1 (DoBE, 2011). On the contrary, the study discovered that there was rather extensive use of code-switching between English and isiXhosa by EFAL teachers from both schools. The teachers' reason for code-switching was learners' inability to communicate fluently in English. Tien and Liu (2006) state that low proficiency students consider code-switching in their EFAL classes as helpful towards gaining better comprehension, especially when providing equivalent comprehension as well as giving classroom procedures.

Moreover, the data revealed that interacting in their L1 was more relaxed than using English because the learners could express their views in a more meaningful way than using English. Furthermore, using isiXhosa was the only way through which they could understand each other during group work and they were able to reach a higher level of understanding by assisting each other. This shows that L1 has become the base on which to extend classroom knowledge through teachers' mediation or facilitation (Harlen & Qualter, 2014). Therefore, the process of scaffolding would have benefited the learners through being assisted to achieve tasks and complete functions in the target language (Ellis, 2009).

Analysis of data indicated that learners struggled to write in English. They could not pronounce some words correctly, which made it difficult for them to be able to write the words. As a result, they wrote words as they heard them, especially phonemes that sound the same as they do in isiXhosa. They struggled to interpret and understand questions that required a higher level of thinking, and this negatively affected their writing proficiency. According to Hua (2002), isiXhosa has a simple syllable structure, and unlike English, it allows for very complex structures. In addition, different orthographies in isiXhosa and English promote different kinds of word recognition processes (Probert & De Vos, 2016).

In addition, analysis of data revealed that learners had inadequate language skills; hence, they translated L1 to EFAL and sometimes incorrectly spelt words. According to Huwari and Al-Shboul (2016), L1 interference is another challenge faced by ESL learners, which is caused by the fact that when they think, they think in their language yet they have to write in English. Apart from that, Byington and Kim (2017) discovered that learners regard what they

learn at school as important if they realise that even their parents partake in the same kinds of activities in their homes. However, Ln F's situation is contrary to the findings of Byington and Kim (2017) as the learner stays with his illiterate grandmother. Therefore, being assisted with homework is not possible.

Furthermore, the study disclosed that learners struggled with poor proficiency in the writing EFAL. According to Sarfraz (2011), writing in L2 makes the task further complicated, as it requires sufficient command of the L2 to fulfil all the formalities, for example composing and developing logical ideas, which are essential for a written text to be comprehensible. Dreher and Gray (2010) point out that, if English language learners are not familiar with the sentence structures within a compare and contrast text, their comprehension of the information or content in the text might be hindered, which impedes their construction of meaning. Thus, it is essential for the teacher to provide effective teaching and learning opportunities that ESL learners should develop in their writing of EFAL.

Conclusion

This study is based on factors affecting isiXhosa speaking learners' writing proficiency in EFAL. Briefly, the study showed that both learners and teachers faced numerous challenges relating to writing proficiently in EFAL. This means that more work still needs to be done in this area, especially in training teachers to position them to assist learners in the development of EFAL writing. The present study argues that; teachers of EFAL learners should approach writing as a critical and core aspect of learners' education. Learners should be exposed to intensive writing activities throughout their school years. Teachers who lack the necessary skills should also be given specific training in teaching writing in particular and the other skills in general. This would go a long way in ensuring that when learners go to institutions of higher education, they are fully equipped to handle academic writing. However, the challenges relating to learners' writing will continue, particularly in EFAL contexts, unless department start addressing academic writing as a critical and core component of isiXhosa speaking learners' academic development.

Recommendations

Teachers need to learn to recognise how much language learners have and how to encourage language use and growth through meaningful conversations. This is because the way learners perceive, remember, comprehend, and make sense of their world is all tied up in language (Bransford et al., 2000). Thus, teaching writing would equip them with the ability to communicate with the world at large.

Teachers need to give equal emphasis to writing as they do to reading comprehension, grammar and vocabulary in their instruction. They need to realise that writing helps learners to reinforce their knowledge of grammar and vocabulary as well as to develop other language skills since language skills are learned interactively. In addition, EFAL teachers should encourage and motivate their learners to participate in class using English more. If this step is taken early in the first class session, learners will get used to this and, therefore, their language exposure and practice will increase. It is up to the teacher to use effective ways to attract shy learners into a discussion. These ways could include using groups, asking opinion questions, etc. In this way, learners will learn, know and understand, and not merely memorise for the exam.

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THE SCHOOL CURRICULUM: WORKING TOWARDS SOCIAL JUSTICE FOR HISTORICALLY DISADVANTAGED LEARNERS

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Abstract

This study explores the theoretical underpinning of the school knowledge codes in curricula since the introduction of democracy in South Africa in 1994. Global educational development across many nations has seen calls to regain a focus on issues of curricular knowledge. This paper draws from the researcher's doctoral study that explores the theoretical bases of recent and current South African curricula and steps into conversation with key players, including social realists, who argue that scientific knowledge should be brought back into the school curriculum. After a discussion of the former national curriculum, namely outcomes-based education (OBE), the first national curriculum in newly democratic South Africa, the paper engages in the Curriculum and Assessment Policy Statement (CAPS), the current national curriculum that espouses scientific knowledge framed in social realism as theoretical perspective. This leads to the discussion on critical realism as developed by Bhaskar, to engage in a mandate for a different curriculum selection. A literature review was undertaken to examine the school knowledge codes as embodied in the theoretical underpinning of OBE, CAPS and the work of Bhaskar as the originator of the critical realist approach. In presenting these debates on curriculum knowledge selection, the aim is to contribute to a contemporary curriculum mandate, which, in turn, can contribute to ongoing debates about social justice and curriculum practices for historically disadvantaged learners. The study concludes that a combination of different kinds of knowledge will enhance the democratic debate about humans in the education system.

Keywords: *Critical realism, Curriculum and Assessment Policy Statement, outcomes-based education, school knowledge codes, social realism.*

Introduction

With the advent of a South African democratic political establishment in 1994, the country was compelled to turn away from the former apartheid curriculum to effect the goals of a newly adopted constitution. At the same time, global educational development across many nations experienced a call for a regained focus on issues of knowledge in the curriculum. Furthermore, various critics have contested the foundations on which curriculum design is based (Young, 2008; Biesta, 2014; Huckle, 2019). For this reason, social realists and other key players have argued for knowledge to be brought back into the curriculum.

Social realists as a group are concerned about bringing formal, scientific knowledge back into the curriculum. Zipin, Fataar, and Brennan (2015) and Mathebula (2019) claimed that South Africa's current national curriculum, the *Curriculum and Assessment Policy Statement* (CAPS), has been significantly influenced by debates regarding a renewed focus on knowledge in the curriculum. Kallaway's (2012) work *History in senior secondary school CAPS 2012 and beyond: A comment* signalled the start of the South African discourse on social realism in educational debates. In his work, Kallaway (2012) has illustrated the significance of history as a main feature of worthwhile knowledge to be taught in schools. Taking cognisance of the fact that social realists overstress cognitive objectives for schooling in ways that oppress axiological (ethical) purposes, this paper discusses Bhaskar's (1975) conceptualisation of critical realism to engage in explanatory critique as avenues of

interpreting reality, including the curriculum. Such an alternative curriculum offering could be regarded as bringing useful knowledge to the school curriculum. The aim of this paper is to contribute to contemporary curriculum mandates adding to ongoing discussions about social justice and curriculum practices, especially for the benefit of historically disadvantaged learners.

Literature Review

To contribute to the abovementioned debate, the paper engages in standpoint relativism (epistemological relativism) as a means to explain the theoretical basis of the first national curriculum in democratic South Africa, namely outcomes-based education (OBE). Thereafter, the discussion proceeds to engage in social realism, explaining the theoretical basis of the current national curriculum, CAPS. The discussion concludes with an engagement in critical realism as developed by Bhaskar (1975), contributing to the curriculum debate about placing the human at the centre of the curriculum or, in other words, 'bringing ethics back into education'.

The Historical Trajectory of Outcomes-based Education

Since 1997, the government of South Africa has implemented a range of curricula designed and intended to offer quality education to all learners in South African schools (Spren & Vally, 2010). The government announced the introduction of OBE with the explicit aim "of creating a transferability of knowledge in real life" (Hugo, 2005, p.22). In this regard, Kallaway (2012) asserted that the dismissal of the apartheid education curriculum was mistaken for the rejection of a curriculum founded on historically constructed knowledge. Whereas apartheid education was characterised by the acquisition of classical knowledge, the OBE curriculum – also referred to in schools as Curriculum 2005 (C2005) – was guided by constructivism. In terms of education, constructivism refers to knowledge attained by learners' self-exploration (Ramatlapanana & Makonye, 2013). Hoadley and Jansen (2009) claimed that if formal knowledge refers to specialised disciplinary knowledge within the school curriculum, it can be assumed that everyday constructed knowledge implies populist working-class knowledge. In comparison to everyday and populist knowledge (as in OBE), scientific, powerful knowledge appears to possess more value within the debate of knowledge production. In this regard, Young (2008) denoted that

[p]owerful knowledge provides more reliable explanations ... for engaging in political, moral, and other kinds of debates ... In modern societies, powerful knowledge is, increasingly, specialised knowledge; and schooling, from this perspective, is about providing access to the specialised knowledge that is embodied in different knowledge domains [emphasis in original] (p. 11)

During the last few years, critics have advocated that scientific knowledge should feature stronger in school curricula (Counsell, 2011; Kallaway, 2012). By implication, classic/scientific knowledge should therefore form the basis of the curriculum instead of the everyday cultural knowledge presented in OBE to children from working-class families.

Since its inception, educators have been confused with OBE and its terminology. Jansen (2012) argued that the confusion started with the dual terms OBE and C2005. It was not clear what C2005 represented and how it would be implemented in the classroom. According to Jansen (2012), teachers and many departmental officials perceived the term C2005 as a deadline, the year by which all the general education phases, Grades 1 to 7, will have had to be introduced to OBE. Other officials believed that C2005 defined the goals of a reformist

approach within which OBE was merely a mechanism to convey the methodology for reaching the goals stipulated in C2005 (Jansen, 2012). As indicated previously, the implementation of OBE/C2005 got off on an ambiguous start. An exigent review was undertaken in 2000.

Outcomes-based Education and Epistemological Relativism

On the international front, Kelly (1986) affirmed that contra-behaviourism and developmental psychology offer support for progressive reform to move past behaviourism in psychology with its preoccupation with prediction, measurement and social control. The progressive-reform tradition aligns itself with “constructivist, enquiry-based pedagogies”, and agrees with the pedagogical principle of building on the existing knowledge of the child (Edwards, 2012, p.170). According to Kallaway (2012), there was a robust dependence on ideas of the constructivist-curriculum design, highlighting the benefits of learning from the social context and the immediate environment of the learner. The idea was to focus on the importance of local knowledge and that learners should learn through self-exploration. These notions of constructivism form the basis of OBE in South Africa.

According to Fakier and Waghid (2004) and Davids (2017), the curriculum and pedagogy in terms of OBE are faulty because OBE insists on interpreting the complexity of human activity in relation to outcomes. Individuals must be allowed to freely articulate reasonable beliefs and certainly not in terms of a fixed set of goals and outcomes. . Zipin, Fataar, and Brennan (2015, p.3) agreed that OBE failed due to a philosophy of “competencies” and a banal “everyday life” basis for the curriculum.

Concerns were also raised by social realists Moore and Muller (1999), who argued that the interpretivist criticisms started by the New Sociology of Education (NSOE) have resulted in relativism and a certain kind of standpoint theory. Moore and Muller (1999) contended that standpoint theory – the idea that the construction of learners’ knowledge in schools is influenced by their culture – has challenged the possibilities for progressive reform. In this regard, Edwards (2012) believed that irrealism – pluralism to knowledge claims – excludes an appeal to any ontological grounds for arbitrating multiple truth claims. Epistemological relativists make the judgment that various groups or cultures have various norms to determine what counts as knowledge. These often-conflicting standards are equally valid and equally good (Harding, 1992; Yucel, 2018). By implication, the theoretical basis of OBE is supported by these notions of relativism.

Moore and Muller (1999) asserted that standpoint relativism usually results in the reproduction of inequality. The truth for standpoint theorists is that dominated groups find it difficult to state their views of the world. On the contrary, the emancipation initially promised by the NSOE led, once again, to cultural reproduction and inequality in society.

At this point, it is important to present an argument to oppose the notion of epistemological relativism. Harding (1992) claimed that standpoint theory requires recognition from the position of sociological relativism. She further suggested that all human enterprises have claims on knowledge construction, but reject epistemological relativism, which implies that all types of knowledge have equal value. In reality, sociological relativism simply states that different cultures have different views on what constitutes as knowledge. Consequently, there is not one single standard that they all accept to be true (Harding, 1992). Different types of knowing, therefore, acknowledge different ways of perceiving reality, and these realities are partial at all times because we have a view from only one single angle (our standpoint) and

not multiple angles simultaneously (Haraway, 1988). Having said that, the renewed focus on curriculum disciplinarity has been the main issue of the South African curriculum review. A new National Curriculum Statement (NCS), namely CAPS, was introduced for Grades 6 to 9 in 2010 and for Grades 10 to 12 in 2011 (Kallaway, 2012; Davids, 2017) due to the arguably unsuccessful implementation of OBE. It is important to note that issues such as method of inquiry, ways of how the natural and social sciences are observed, and how knowledge is generated in the world will ultimately manifest in the national school curriculum. Notions of constructivism regarding learning through the construction of one's own knowledge and through self-exploration made way for a new movement – social realism. Social realism makes reference to powerful scientific, disciplinary knowledge within the school curriculum and not the ordinary everyday knowledge that was embraced by OBE.

The Curriculum and Assessment Policy Statement and Social Realism

Harding's (1992) main claim about sociological relativism is that knowledge should confirm that all types of knowledge are only partially objective. This approach not only considers structural power relations as an object of sociological objectification, but further assumes that "explanatory power can be obtained through the hard work of specialist knowledge communities to map systematic causalities across the partial objectivities that they research" (Harding, 1992, p.582).

Kallaway (2012, p.26) recognised, for example, that preference is given to forms of "disciplinary knowledge as a mechanism for exploring issues of similarity and difference; change and continuity and cause and consequences" in the CAPS history curriculum (Department of Basic Education [DBE], 2011, Section 2.3.2). This reference to disciplinary knowledge is similar to Counsell's (2011, p.202) remark that the history curriculum in the UK conveys "an epistemic tradition to the pedagogical site so that pupils can understand the grounds on which valid claims about the past can be made". In this regard, disciplinary knowledge that makes use of concepts and related processes, and particularly in the history curriculum, is therefore followed through to the utilisation of educational strategies that are motivated by the ideas of the engaged exploration of the structure and forms of historical knowledge (Counsell, 2011). Therefore, the history curriculum recognises the continuity of communication between intellectual generations within certain themes (Bourdieu, 2003) over long periods of time.

Kallaway (2012) argued decisively that a disciplinary curriculum such as history, for example, should introduce learners to the method of inquiry accustomed with the discipline itself to obtain a range of cognitive skills and abilities aligned to the specific discipline. Rigorous disciplinary knowledge consequently began to take root as a critique of constructivism in the form of an academic movement called social realism (Zipin et al., 2015). Social realism as a curriculum mandate proposes scientific, objective knowledge for learners to engage in disciplinary knowledge. Accordingly, in South Africa, social realism as an educational movement forms the theoretical basis on which CAPS is based.

Following on the above discussion, it can be concluded that whereas constructivism informed the theoretical basis of OBE, it was the critique thereof that led the way for social realism as the curriculum mandate. Such scientific knowledge prepares learners to engage in disciplinary knowledge in schools. Within the South African educational context, knowledge relating to learners' standpoints was consequently removed from the curriculum to bring formal disciplinary knowledge back into the curriculum.

Social realism is criticised by thinkers such as Lawson (1997) and Hammersley (2011), who questioned whether curriculum knowledge is limited to knowledge generated by a small cross section of members of society who are university researchers and are subsequently open to potential ideological distortion. This, again, could proceed through schooling, reproducing privileged groups in society. The contention is that social realists are wrong to suggest that knowledge-producing communities can be separated from the wider society. The problem of social realism is the privileging of social facts and the lack of the required “reflexivity to practically overturn unwanted structures” (Edwards, 2012, p.180). The implication for curriculum is a subsequent privileging of scientifically powerful knowledge that advances the interests of the middle class while adversely disadvantaging marginal people. . Zipin, Fataar, and Brennan. (2015) attested that social realism determines the knowledge to be included in the curriculum, overstressing the cognitive objectives of schooling while excluding moral (ethical) purposes. In addition, Christie (2020) argued that post-apartheid curriculum unquestioningly adopts Eurocentrism and presents it as the only path towards critical thinking and learning that is meaningful. In agreement with this, Mathebula (2019) claimed that CAPS operates in the sphere of an academic curriculum. African indigenous knowledge in the same curriculum, however, is conspicuously presented in terms of a narrow African tradition of acquaintance and practical knowledge. As a consequence, social realism notions of what social-educational justice is, are too lightweight to accommodate the fundamental needs and aspirations among advantaged-disadvantaged collectives for the bettering of lives through education. This applies not only to South Africa, but globally as well. It is in this regard that this paper intends to draw on a critical realist position as an attempt to advance the curriculum debate.

Critical Realism: A Critical Turn in Scientific Realism

In offering arguments on warrants for curriculum knowledge selection, this paper proposes the addition of a different curriculum mandate that could contribute to ongoing discussions about social justice and curricular provisions for historically disadvantaged learners. It is with this objective in mind that this section discusses critical realism as developed by Bhaskar (1975, 1979) as a more developed form of realism. Critical realism arose in the last part of the previous century from two schools of thought. The first of these, a “*critical current*”, originating from Marx, Nietzsche and Freud, emphasises the socially constructed nature of knowledge. The second, the “*realist ontological current*”, stresses the power of science to elucidate and foretell facts and events in the natural world (Shipway, 2011, 13). Lukács (1971) and Bhaskar (1979), who are both allied with critical realism and draw upon the critical current and in particular on Marx’s ontological current, believed that a worthwhile reality can only be known through “a socially constructed medium that is prone to partiality and error” (Edwards, 2012, 171). In support of this, Yucel (2018) claimed that in critical realism, knowledge is seen to be relative to human subjective factors which influence the construction of knowledge.

Theoretical Markers of Critical Realism

According to Hacking (1983), Bhaskar believes that the natural sciences mostly isolate causal mechanisms by way of strong interventions that create indirect observations of the world. Gorski (2013, 662) added that social scientists have not been successful in discovering any “covering laws” because they are unable to produce experimental closure. The second reason seems to be that social structures are not only dependent on human action and culture, but they differ over space and time to a greater degree than physical structures (Gorski, 2013). In his book *A realist theory of science*, Bhaskar (1975) referred to his approach to natural science as “transcendental realism”. This approach is “realist” in the broad sense, since a

“mind-independent nature” functions as an essential “condition of possibility” for natural science (Gorski, 2013, 664). However, Bhaskar asserted that the realist constituent is also realist in the “critical” manner, as it observes science to be a human activity that is inevitably mediated by language and human and social control (Gorski, 2013).

Gorski (2013) explained Bhaskar’s (1979) argument as if reality can be effectively analysed through a diverse spatio-temporal continuum. If the physical and biological sciences are moderately independent from each other, this is by some degree partially so because nature is, in essence, organised in a manner of various stratum. A key principle in Bhaskar’s work is the concept of the social sciences and their interrelation to the natural sciences. His own beliefs as a critical naturalist require the rejection of any harsh division between the natural and social sciences. Corson (1991, p.231), in particular argued that “Bhaskar’s naturalism is ontological rather than epistemological in its fundamentals as it incorporates the social world as an intrinsic part of the scientific world”. For Corson (1991), Bhaskar argued that critical naturalism and particularly the changed model of social actions that originated from it involve the start of explanatory critique in social science. Bhaskar (1993, p.7) pointed to “dialectics” as the thought of understanding and comprehending conceptions of life in their interconnections and not only in terms of their determinate differences. He considered every development as the total of a previous, less developed phase of which the basic truth is still in the process of becoming. At the same time, Gorski (2013) claimed that Bhaskar’s question on how social science can traverse the “*is/ought divide*” is actually about how social science uses dialectics to make sense between the natural and social sciences.

Bhaskar’s (1979) critical realism proclaims that it will only be feasible to understand and change the social world if we acknowledge the structures that are working in the interests of the privileged. For Bhaskar (1989, as cited in Corson, 1991, 232), freedom takes place when we can make a change from “unwanted to wanted sources of determination”. The focus is subsequently placed on transforming the relationship between agency and structural context to support the development of such emancipation.

Corson (1991, 233) affirmed that “[s]ince society for Bhaskar pre-exists the individual, then in changing society human activity goes to work on objects that are given”. Bhaskar (1979, as cited in Gorski, 2013) argued that the reproduction of certain kinds of social structures may be affected by the production of distorted or inaccurate social beliefs. Bhaskar continued that if one can find a systematic connection between inaccurate beliefs and oppressive social structures, then one has not only described such beliefs but also offered a motivation for altering the structures. Significantly, this means that one has made the shift from facts to values. For Bhaskar, this does not necessarily mean that explanatory critique is sufficient to encourage action in itself, but it is “always a matter of will, desire, sentiment, capacities, facilities, and opportunities as well as beliefs” (Gorski, 2013, 667).

In this respect, evaluative structures about the social sciences could, in reality, render a more accurate account. Liberation consequently comes about when we move from “unwanted to wanted sources of determination” (cf. Bhaskar, 1979, as cited in Corson, 1991, 232). In other words, *dialectics and reflexivity* in relation to moral and ethical contemplations could achieve social justice.

Implications for Curriculum Selection

As discussed in the above sections, social realists make an argument for *objectivity* as opposed to *neutrality*. For education, this means that the content of the curriculum makes

provision for formal, scientific knowledge. The contention is that the school curriculum has been designed by distant research communities, implying that learners are the uncritical receivers of a curriculum. Furthermore, knowledge production with regard to social realism is far removed from the school and learner communities. Edwards (2012) contended that

[t]here is no mechanism by which distortion and error may be challenged since, without a transactional account of the relation between structure and agency, there is no possibility for an agent to ‘act back’ upon structure. (p. 179)

Zipin et al. (2015) claimed that social realists are serious about scientific communities as the social current promises increasingly larger estimates of objective truth. Social realism has played its role in moving away from a fragile OBE curriculum. To advance the discourse from a weak OBE curriculum, capacities to bring knowledge and ethics back to the centre are required for a democratic dialogue about curriculum among academics, policymakers and the broader public.

Knowledge production should offer a better version of the real forms and processes of change (Gorski, 2013; Huckle, 2019). Critical realism proposes a developing, changed relationship between structure and action (Edwards, 2012). Standpoints are always defined by the particular socio-historical period of time in which individuals find themselves. In the South African context, the socio-historical orientation plays a vital part in curriculum matters. Reference to our complex history of colonialism and the apartheid system should be included in the curriculum content.

The following question could be asked in current educational debates: Did the transformation agenda bring about the required changes? Fataar (2017) argued that an analysis of CAPS exposes a thin pedagogical transfer which indicates an ethics-free form of curriculum provision. For him, the sociological worlds which learners bring to their schools require placing the human at the centre of the curriculum. Christie (2020, p.205) called for “a different ethical imagination informing the provision of an education which values intellectual rigour as well as care for others and a common good, and a political commitment to working collectively to achieve this”.

The human as a historical being becomes a pivotal point in the South African context. It has become crucial for schools to take the life worlds of learners into account, especially those of poor, historically disadvantaged learners. By implication, critical realism has foregrounded that liberatory power can be activated by a combination of different types of knowledge and not simply a representation of one layer of society. To incorporate all people’s historical, political, cultural and socio-economic contexts will enhance the democratic debate about humans in the education system.

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INFORMATION AND COMMUNICATION TECHNOLOGIES TO CHANGE EDUCATION

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Abstract

The purpose of the study reported on in this paper was to provide a perspective on the affordances and acceptance of innovative technologies and learning in Information and Communication Technology (ICT) courses, against the background of challenges related to the effective teaching of programming students in an environment, which offers open access to education and learning. Concepts around pedagogies for innovative technologies are formulated within a conceptual/theoretical background and frameworks and supported by literature on the affordances and acceptance of technology enhanced learning, to clearly outline the contribution to the field of this paper regarding originality and significance. In the research reported on in this paper, the design of the study adopted consisted of a non-experimental quantitative methodology, with the instrument used for data collection being a survey, and study participants as sample representing 19% of the student population. Details with regard to the validity and reliability of the instrument and analysis are also provided. Apart from demographic details collected, a discussion of results follows on how much the innovative technologies for learning were used, participation in discussion forums, viewing vodcasts, participating in blogs, participating in online-meetings and participating in self-assessments, as indicated by the students in these courses. Also included is how e.g. students contacted their lecturer and e-tutors. With regard to the conclusions drawn, recommendations are formulated regarding the improvement of the implementation of pedagogies for innovative technologies related to programming for open access to education and learning. Implications for higher education institutions with regard to transforming towards effective teaching and technology enhanced learning are also provided.

Keywords: *Information and Communication Technologies, Change Education*

1. Introduction

Enterprises are increasingly moving towards digitization, enabled through innovative technologies (Bolton, Goosen, & Kritzinger, Enterprise Digitization Enablement Through Unified Communication and Collaboration, 2016), while educational technologies are being used for growing innovative e-schools in the 21st century, often in the shape of a community engagement project (Goosen, 2015b). Within a framework for university partnerships promoting the continued support of such e-schools (Vorster & Goosen, A Framework for University Partnerships Promoting Continued Support of e-Schools, 2017), the growth of fourth industrial revolution Information and Communication Technology (ICT) students is promoted, as this has implications for Open and Distance e-Learning (ODEL) (Van Heerden & Goosen, 2020). Pedagogies for innovative technologies are therefore being used to inspire learning in the College of Science, Engineering and Technology (CSET), towards smartly using innovative technologies to facilitate teaching and learning (Libbrecht & Goosen, Using ICTs to Facilitate Multilingual Mathematics Teaching and Learning, 2016) for these ICT students. This is achieved by modelling course-design characteristics, Self-Regulated Learning (SDL) and the mediating effect of knowledge-sharing behavior as drivers of innovative behavior (Ngugi & Goosen, Modelling Course-Design Characteristics, Self-

Regulated Learning and the Mediating Effect of Knowledge-Sharing Behavior as Drivers of Individual Innovative Behavior, 2018).

1.1 Purpose/objectives of the paper

Despite attempts to move beyond the horizon with qualitative perspectives on learning programming with innovative technologies for open access to education and learning (Goosen & Van Heerden, 2017), by implementing various pedagogies for innovative technologies to support technology enhanced learning, the purpose of the research addressed in this paper is related to reducing the high dropout rate for the introductory programming courses described in this paper (Yadin, 2011), which remains problematic and is a university wide problem, as further elaborated on in, for example, Goosen and Van Heerden (2017), (2018) and (2019b).

In light of the overall purpose of the paper, related to reducing the high dropout rate for the introductory programming courses, the objectives were therefore are to establish:

1. what role personal motivation plays in the uptake of pedagogies for innovative technologies;
2. which logistical factors influence the uptake of technology-enhanced learning.

1.2 Research questions

The main research question stated for this paper therefore is: How can the uptake of innovative technologies and learning by first year programming students with open access to education and learning be increased? In order to further elaborate on this, the secondary research questions that will be addressed in this paper are:

What role does personal motivation play in the uptake of pedagogies for innovative technologies?

Which logistical factors influence the uptake of technology-enhanced learning?

2. Conceptual/theoretical background and frameworks

Theory informs practice and without an excellent theoretical base, we risk having a weakened convention. This can be clearly noticed when looking at the education sector, in which the teaching pedagogy is directly shaped by the theoretical traditions underpinning one's teaching philosophy. However, having said this it, becomes apparent in the research that there is a lack of a clearly set out theoretical framework when it comes to choosing the 'best' Learning Management System (LMS) technologies, which to use in the field of teaching and learning a programming language. Although Ariffin, Rahman, Alias and Sardi (2015, p. 82) did not specify a specific theoretical framework, the latter authors did identify four independent variables affecting the utilization of a learning management system: "the students' technology competency, students' access to i-Class, lecturers' initiative, and students' " perception of the usefulness of their utilization of the i-Class.

While Bryceson (2007) investigated a new model using social constructivism concepts in terms of both learning and knowledge management theories, in an attempt to identify a theoretical framework for the online learning environment, Asiri, Mahmud, Abu Bakar and Mohd Ayub (2012) based the theoretical framework they used in their research on factors influencing the use of learning management systems in Saudi Arabian higher education on the Theory of Reasoned Action and the Technology Acceptance Model (TAM). Park (2009) also made use of an analysis of the Technology Acceptance Model to understand university students' behavioural intention to use e-learning. In turn, the study by Gautreau (2011), on motivational factors affecting the integration of a learning management system by faculty,

was based on the motivational hygiene theory, the diffusion of innovations theory and the change theory as it relates to technology integration. Cavus (2007), on the other hand, used the cognitive learning theory, situated learning theory and the constructivist learning theory to assess the success rate of students using a learning management system, together with a collaborative technology, in web-based teaching of programming languages. Whereas Swan and Ice (2010) investigated the Community of Inquiry framework and its various implementations in studying the use of online learning, Agudo-Peregrina, Iglesias-Pradas, Conde-Gonzalez and Hernandez-Garcia (2014) stated that “the novelty of this research field implies that there is not yet solid theoretical framework available when it comes to” deciding “which specific data must be analysed, and more fragmentation is introduced by the great diversity of learning systems and technologies available in the different educational institutions”. This research will thus not make use of a single theoretical framework, but will contribute towards the identification of a theoretical framework, which might be used in future studies.

Using an activity theory perspective, Van der Merwe and Van Heerden (2013, p. 269) found the ‘Big Blue Button’ Meetings (webinar) technology to be easy to use and useful for purposes of hosting presentations on a web server - when a top-down approach to teaching and learning is applicable, “then that is how it should be used.” In an environment, where students are spread geographically and have many different working environments, it is logistically impossible to have face-to-face meetings with all the students. It is, however, important to provide students with the opportunity to address pressing issues, such as their assignments and examination preparation, with their lecturers. The LMS technology that provides for leveraging webinars to support learning is the online meeting or WEBINAR (WEB-based-semINAR), which allows for students to log on to the LMS and become part of a presentation via audio, video, text and other forms of live interaction. Online meetings are arranged with the students to discuss their practical assignments and their examinations; this is in line with findings from Van der Merwe and Van Heerden (2013, p. 266), which showed “the majority of students to prefer an instructor-led webinar on content/topics decided by the instructor.” The online sessions are also scheduled at different time intervals on different days in an attempt to reach as many students as possible.

Unlike students who attend contact or face-to-face universities, ODeL students do not have the opportunity to attend computer laboratory sessions where they can be shown how the theoretical concepts are applied in a practical context. The Discussion Forum technology in the LMS provides for an environment where students can share their programming experiences. Specific topics related to practical activities the students have to complete are created; in these, students can ask questions or add topics of their own related to the activity. The students are encouraged to share code they are experiencing problems within these forums. Similar to contact classes, all students in a group benefits from the question asked by a student, answer supplied by the lecturer and guidance received from fellow students. The discussion forum technology provides students with opportunities for situated learning in a ubiquitous computing ‘classroom’, to create a knowledge community where they can share their learning experiences (Lin, Kratcoski, & Swan, 2005).

In an ODeL environment, where class sizes range from 400 to 800 students per semester, Ramasamy, Valloo, Malathy, and Nadan (2010) showed the effectiveness of the Blog technology to support learning in a programming course.

The contact university affords the lecturer the opportunity to have quick class tests to determine if students have grasped specific theoretical concepts. Ibabe and Jauregizar (2009) showed how the online self-assessment technology allowed for students to metacognitively self-assess their theoretical knowledge and receive immediate feedback.

3. Methods/techniques

In the research reported on in the paper, the **design of this study** adopted consisted of a non-experimental quantitative methodology.

3.1 Data collection instrument(s)

The questionnaire, compiled by the first author, was created as a Google form and students were sent e-mail and SMS invitations to complete the surveys. Data collection took place during the first and second semesters of 2015 through 2018 - this is the timeframe, which ethical clearance had been granted for. Data were also collected from the institutional learning management system during the same time frame. Documentation included examples of the use of the learning management system technologies during this time by both the students and the lecturer.

The data included the biographical information of the students, as well as the throughput and dropout rates as indicated in the institutional information and analysis portal.

3.2 Validity/Reliability of Instrument(s)

Questions from the research of Bennedsen and Caspersen (2007) and Bergin and Reilly (2005), as well as the university's Student Course Evaluation (SCE) as reported in, for example, Goosen and Van Heerden (2016), were adapted to seek feedback for understanding the phenomenon under study. The latter studies provided questions with regard to failure rates in introductory programming (Bennedsen & Caspersen, 2007), towards turning the tide with a socio-critical model and framework for improving student success in open and distance e-learning at the University of South Africa, as well as, for example, learning management system technologies to address online and open distance education environment challenges (Goosen & Van Heerden, 2016).

The survey as instrument was validated by having it reviewed by two specialists in open and distance e-learning with experience in teaching programming languages, who not only validated the instrument, but also further identified important items not included in the questionnaire, which were subsequently added.

To reinforce and assess the reliability of the instrument in this research, information systems architecture and technology aspects relating to the usability attributes and evaluation methods of websites (Ajibola & Goosen, Development of Heuristics for Usability Evaluation of M-Commerce Applications, 2017) in terms of test-retest reliability was implemented to assess stability. The same questionnaire was used three times and a comparison of scores was obtained. The stated reliability index of the instrument and comparison procedure involved in determining the reliability coefficient was performed objectively by computing the latter.

3.3 Sample/Sampling technique

The assessment practices for the courses ICT1512 and ICT1513 reported on in this paper are for the students registered for the courses from semester 1 of 2015 to semester 2 of 2018. The total population of students in this group was 7 698 and they were distributed across the semesters as indicated in Table 1.

Table. 9. The population of students distributed across the semesters.

	S1- 2015	S2- 2015	S1- 2016	S2- 2016	S1- 2017	S2- 2017	S1- 2018	S2- 2018
ICT1512	698	592	500	436	418	365	359	349
ICT1513	838	671	469	384	405	375	469	370

The sampling technique adopted for the research reported on in this paper was based on self-selection, resulting in those students, who chose to respond to the invitation to take part in the survey, forming the sample, with the sample size representing 19% of the population.

3.4 Ethical Issues

With regard to the ethical issues considered in this paper, Slade and Prinsloo (2013, p. 2) proposed six specific principles as a framework, which were considered “to guide higher education institutions to address ethical issues” and dilemmas “in learning as analytics and challenges in” environment-dependent and appropriate ways. More detailed information on ethical data management and research integrity in an environment, such as the one described in this paper, is provided in a chapter (Goosen, 2018) on ethical Information and Communication Technologies for Development (ICT4D) solutions for Massive Open Online Courses (MOOCs) (Goosen, 2015a).

3.5 Method of data analysis

In the study reported on in this paper, the method of data analysis, which was used, was similar to what was described by Park (2009).

4. Results/findings & Discussion

A noticeable decline in the number of students registered for the courses as displayed in Table 1 are evident since 2015 after the implementation of mathematics as a pre-requisite for the Diploma in Information Technology qualification. The fluctuation of student numbers might furthermore be attributed to various external social and economic factors, as well as internal factors, such as admission and registration policies.

Yadin (2011) provided a comprehensive summary of the reasons the throughput rates of first year programming courses are problematic for many institutions, and dropout rates in such introductory courses need to be reduced. Corresponding to especially the latter objective, the purpose of the paper was therefore related to reducing the high dropout rate for the introductory programming courses under investigation.

On average, 77% of the students indicated an African language as their mother tongue, with 14% indicating English as their first language, and other languages for the remainder. Van Heerden and Goosen (2020) indicated that the ICT subject field is predominantly English, and these courses are therefore presented only in English. In line with Park (2009), it is recommended that course designers should endeavour to understand how these university students’ behavioural intention to make use of e-learning might be influenced by the suitability of language options available to them.

In support of the main research question on increasing the uptake of innovative technologies and learning by first year programming students with open access to education and learning,

and specifically related to the first objective addressed in terms of how personal motivation played a role in students' uptake of pedagogies for such technologies, results corresponded with those of Bergin and Reilly (2005) with regard to the influence of motivation and comfort-level on meaningfully learning to program, as well as Gautreau (2011), in terms of motivational factors affecting the integration of a LMS.

An average of 35% of the responding students were female and 65% male. Based on literature, these demographic variables of the students are comparable to those reported in Van Heerden and Goosen (2012) and (2020), as well as Goosen and Van Heerden (2013b). Especially Van Heerden and Goosen (2020, p. 135) pointed out that it was "however, very important to provide extra motivation and support to the female students, due to the national shortage of females in fields" represented in CSET.

Similar to the university profile across all students, the ages of students doing these courses show that 5% of students were younger than the age of 19, 71% were between the ages of 20 and 29, 19% were between the ages of 30 and 39, with the remaining 5% being older than 40. Van Heerden and Goosen (2020, p. 135) further indicated that studying through ODeL should be undertaken by mature "students, who are able to take responsibility for their studies and have the stability and discipline to make a success of it." Attempts to keep such students motivated could include appropriately modelling course-design characteristics, SDL and the mediating effect of knowledge-sharing behavior as drivers (Ngugi & Goosen, *Modelling Course-Design Characteristics, Self-Regulated Learning and the Mediating Effect of Knowledge-Sharing Behavior as Drivers of Individual Innovative Behavior*, 2018).

The majority of the students doing these courses resided in urban suburbs (56%), small rural towns (18% of the students) and townships (16%). The remaining 10% were divided between rural farms and inner-city dwellings. Similar to the research presented by Asiri, et al. (2012), and responding to the second objective for the current study, students' residential location was established to be one of the logistical factors influencing their uptake of technology-enhanced learning via the LMS.

Of the responding students, 53% indicated that they have access to a computer with internet access, both at home and at the office, 31% indicated at home only and 9% at the office only. University regional centres assisted 4% of students to gain access and 3% of the students made use of public computer facilities, such as their local library or an internet café, as well as information systems architecture and enterprise information technology at the institutions where they work – like that of Ariffin, et al. (2015), these research results from the survey clearly point out students' access to such resources as another one of the factors affecting their utilization of the LMS at this higher education institution.

The programming proficiency of students doing these courses differ significantly, with 35% indicating that they had no programming experience, while 46% had played around with programming, or did it at school level. The remaining 29% of students have done some formal courses in programming. Especially if this is a student's first programming language, they might need additional guidelines and/or access to more information systems and technologies to support their learning – in line with the second objective set for this paper, especially the latter students should be encouraged to take up the technology-enhanced learning opportunities they are being offered in these courses.

Despite the varying student numbers, the biographical information of the students remained quite similar over the four years under review in this study. The full/part-time ratio of the students averages 70% part-time and 30% full-time, with the definition of part-time students including those, who indicated that they were employed. Comparatively, Van Heerden and Goosen (2020) indicated that more than half of the students in that particular sample were employed, while only 11% were employed on a part-time basis.

Table 1 in Goosen and Van Heerden (2016) showed that the respondents to the student course evaluation indicated that 43% of them preferred to contact their lecturer via the discussion forum, 28% indicated e-mail and a mere 6% indicated using the telephone as their preferred method of contact. This is a clear indication that students find the discussion forum technology beneficial to their studies, which supports the research of Shana (2009, p. 214), who concluded that when it comes to information systems and technologies to support learning, the implementation of discussion forums to augment a traditional-style class “had an obvious impact on student achievement and” attitudes in a distance learning/educational technology course.

Apart from the measures already mentioned with regard to assessing the success rate of students’ using a LMS in the teaching of programming languages (Cavus, 2007), project-based learning and assessment (Goosen & Van Heerden, 2013a) have also been shown to influence the pass rates of an ICT course at an ODeL institution (Goosen & Van Heerden, 2013b).

5. Conclusion

The contribution to the field of this paper regarding originality and significance was clearly outlined in terms of concepts around pedagogies for innovative technologies are formulated within a conceptual/theoretical background and frameworks and supported by literature on the affordances and acceptance of technology enhanced learning.

In terms of linking the results to the theoretical framework, like the work by Agudo-Peregrina, et al. (2014), results in this study showed that students’ success can be predicted, to some extent, from log data related to innovative technologies and learning, specifically through the classification of interactions for meaningful learning analytics and their relation with performance in LMS-supported face-to-face and online learning. Similar to Asiri, et al. (2012), this paper not only provided a theoretical framework, but the research questions were also answered. Ariffin, et al. (2015), this research also used a survey to look at the factors influencing the uptake of LMS technologies.

With regard to how the uptake of innovative technologies and learning by first year ICT students with open access to education and learning can be increased, the results showed that innovative technologies, such as vodcasts (Van Heerden & Goosen, 2012), were being used to effectively teach programming for students with open access to education and learning (Goosen & Van Heerden, 2015).

The student course evaluation reported on by Goosen and Van Heerden (2016) did not address the reasons students engaged or did not engage with the discussion forum, and it is therefore recommended that this provides scope for further research to be conducted to identify these reasons for programming students’ engagement with, and participation in, opportunities towards effective teaching and meaningful e-learning in an ODeL environment.

Finally, the results reported in this paper showed that these courses are not only providing relevant and quality Information and Communication Technology education, but also promoting research-based opportunities for computer lecturers using their institutional LMS for ICT education in the cyber world for first year programming students (Goosen & Van Heerden, 2019a), with research on technology-supported teaching, information systems and innovative technologies opening new worlds to support learning.

As a conference paper like this allows only limited space, for more depth of research in terms of the educational scholarly background of these courses, the following can be accessed:

- Van Heerden and Goosen (2012) and (2020), while Van Heerden and Goosen (2019) specifically provided details on the assessments used in an open distance e-learning environment to promote self-directed learning, as well as
- Goosen and Van Heerden (2013a); (2013b); (2015); (2016); (2017); (2018); (2019a) and (2019b).

7. References

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ROLE PLAYED BY THE LIBRARY TO PROMOTE A CULTURE OF READING AMONG LEARNERS

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Abstract

Learners displayed difficulties in reading. Even when a simple text was given to them, they had some difficulties in pronouncing simple words. This study investigated how the role played by the library promotes the culture of reading among learners. The qualitative research approach was most appropriate for smaller samples used. A case study design provided tools to study complex phenomena within the contexts of this paper. Five primary school teachers were conveniently selected from various schools around the Qumbu Education district. Data were collected through the semi-structured interviews, then analysed and interpreted thematically. It emerged from the analysed data that there seemed to be a lack of intervention strategies with regards to available libraries as resource centres. Learners had limited exposure to a wide range of reading materials. The findings of this study also revealed that encouraging reading remains one of the basic skills in learning and this was being compromised due to limited accessibility to libraries. The study concludes and recommends that the library should adhere to marketing strategies for awareness to diverse users, so as for a culture of reading to be instilled. This would lead to improved reading proficiency in learners; hence reading habits influence academic performance.

Keywords: *Books, Library roles, a culture of reading.*

Introduction

Several studies have been carried out on school libraries in the African region. Ogbonna (2015) states that there was a positive correlation on the role of school libraries in Malawi in the promotion of culture, literacy and a reading culture. In Nigeria, Umeh (2015) highlighted a number of factors hindering the growth of such resource centres. These factors included lack of qualified staff, low funding levels and divided administrative responsibilities for libraries. In South Africa, school library survey established that only 8% of public schools in South Africa have functional libraries. These are almost entirely situated in former model C schools which have the resources to stock and staff these facilities (Western Cape Education Department, 2012). Most schools in South Africa simply do not have the means to run libraries (Boekhorst & Britz 2004). In May 2011 the National Education Infrastructure Management System (NEIMS) report showed that although 21% state schools had libraries, only 7% had kept libraries and 79% had no library at all (Department of Basic Education, Republic of South Africa, 2011a). This is in spite of the links made by research regarding learner achievement, and the presence of libraries in South Africa (Lance, Rodney & Russell, 2007; Scholastic Library Publishing, 2008). More precisely, links have been made to the lack of books and the poor results in literacy in South Africa (DBE 2010; National Education Evaluation and Development Unit, 2013). Identifying and understanding the library roles on motivating reading should lead to revised library strategies so as to instil a culture of reading among learners (Evans, Joubert & Meier, 2017).

With reference to the above, it is therefore important to note that learners at primary schools in the district studied have difficulty in reading (Dent, 2016). Learners do not have books to read when at home and neither do they have access to a wide range of reading material. Following a growing concern about the lack of a reading culture among South Africans in

general and primary school learners in particular, this paper deemed it necessary to investigate how libraries promote a culture of reading among learners in primary schools (Dent & Goodman, 2015). It is widely known that the cultivation of a reading culture among the youth in primary schools not only boosts their academic excellence, it also contributes to their country's growth prospects (Kirk, 2016). The objective of this research paper was to establish the role played by the library in promoting a culture of reading among primary school learners.

Review of Literature

Libraries provide free and equitable access to information for all, be it in written, electronic or audio-visual form (Thompson, 2015). They play a key role in creating literate environments and promoting literacy by offering relevant and attractive reading material for all ages and all literacy levels and by offering adult and family literacy classes (Kaisa, 2014). Libraries assist in finding, using and interpreting appropriate information that opens up opportunities for lifelong learning, literacy enhancement, informed citizenship, recreation, creative imagination, individual research, critical thinking and ultimately, empowerment in an increasingly complex world (Hyoky & Kyllonen, 2013). However, there seems to be limited usage of libraries as learners still experience problems in reading. As education involves not merely memorizing information but the ability to learn independently throughout life, learners need to learn how to do research on their own and to explore a subject beyond the information that is given in class. Teachers could encourage these critical literacy skills by introducing learners to the library and by teaching them information retrieval skills.

One of the factors which affect the promotion of a reading culture is limited and poor access to libraries. This is compounded that most libraries have inadequate library materials and poor infrastructure. Despite efforts to improve educational resources throughout the continent, most school libraries in Africa still suffer from lack of funds and lack of attention (Chettri & Rout 2013). The school library is often considered as a "by the way" issue and often, at times, is given inadequate funding or no budgetary allocation. This usually leads to poor provision of reading facilities which leads to a lack of understanding and grasping of the concept of reading as learners do not develop the attitude of self-discovery by self.

The benefits of school libraries suggest that every school has an efficient library. Literature as reviewed above, however, indicates that efficient school libraries are not common in Africa. As a country strives to improve the culture of reading and improve literacy levels, school libraries have an important role to play (Kaisa, 2014). Students and professionals need a strategy designed by the library to help them become proficient in reading in order to help them learn more effectively and proficiently (Marton, 2015). Librarians play a very vital role in this regard. It is the duty of the library staff to assist clients, in this regard clients being learners who have to know how to peruse books (or whatever sources) so as to gather as much information as required. People who are responsible for performing this task at school level are teachers.

The classroom libraries run by the READ Educational Trust in South Africa are considered to be an excellent alternative to a cost-intensive school library for establishing a literate environment in the school (Owusu-Acheaw & Larson, 2014)). The interest in the use of a library can be promoted by schools themselves through provision and arrangement of relevant reading materials in an attractive environment (Erho, Salla & Jerndahl, 2015). This can enhance learners' interests and proficiency in reading. The extent to which learners use

these resources can be enhanced through the library-planned promotion activities such as the summer reading program for learners, reading competitions and celebrations of a yearly library week to inform learners of library facilities and resources as well as public awareness creation on new arrivals in the library by librarians (Winter, 2014).

Theoretical framework

This study is underpinned by Bartlett's Schema Theory (Bartlett, 1932). The theory describes the process by which readers combine their own background knowledge with the information in a text to comprehend that text. This is an important concept in English Second Language (ESL) teaching, whereby pre-reading tasks are often designed to build or activate learner's schemata. The underlying assumption is that meaning does not lie solely in the print itself, but interacts with the cognitive structure or schemata already present in the reader's mind. These schemata represent the "ideational" scaffolding or framework for understanding new information.

Anderson (1978) argues that learners construct very specific schema to account for situations and events which occur frequently in their environment. A particular reader's interpretation of a printed message is influenced by the reader's personal background and history, knowledge, and beliefs which are brought to bear in constructing schemata to provide the interpretative framework for comprehending discourse (Metz, Preciado, Sabbaghan, Pinchbeck, Aljarrah & Davis, 2016). The effect of prior experience can be so great that a reader may perceive only one interpretation for a text to the exclusion of other possible interpretations (Brozo, 2014). Schemata also serve as the vehicles for searching memory for previously read material and reconstructing meaning.

The implications for the instruction is that schema theory has placed new emphasis on various roles played by libraries to improve reading proficiency in learners, particularly the importance of utilizing pre-existing knowledge and experience of the reader on how to interact with various reading materials (Greenberg, 2015). Having sufficient schema, or background knowledge, gives learners some motivation to uplift their comprehension levels. Bantwini and Feza (2016) further support this view by stating that learning resources carry value in determining learning, well-resourced schools are found in areas where people of higher socio-economic status are located. For example, in the case of science learning such schools will have school science laboratories and adequate materials to conduct experiments. While learners from poor socio-economic status will not be exposed to such experiments, but rather to rote learning. Molokoe and Ndandani (2014), cited by Bantwini and Feza (2016), indicate that schools in farm and poor communities hardly receive serious and committed attention from higher level offices of the department.

Further than that, Bantwini and Feza (2016) argue that the role of academic success and performance can be closely observed in the text students are exposed to. For example, the stories in school books that represent the dominant culture, examples used that originate from the lifestyle of the dominant culture, determine the use of language itself. It is here that the role played by the library is significant, as libraries have the potential to strengthen and promote a culture of reading among learners.

Methodology

Research Approach

A qualitative approach was adopted to help researchers collect facts about human behaviour and to study real-world situations as they unfolded naturally without predetermined constraints. Thus lead to verification and extension of theories with regards to the roles played by libraries on the processes of enhancing readability amongst learners (Neuman, 2013). The authors thereby sought a detailed understanding of the teachers' perspectives in this regard.

Research Design

A case study provided tools for us to study complex phenomena within their contexts (Fick, 2014) more-so because we could not consider the case without the context of teaching, learning and classroom settings. It would have been impossible for us to have a true picture of the library roles without considering the context within which the schooling situation occurred.

Population of the Study

Language teachers from all the schools in the entire district where research was conducted entailed the population of the study (Mackey & Gass, 2016). Given the qualitative nature of the study, this group was perceived to yield the relevant information pertaining the topic investigated. A sample for the purposes of this paper comprised five participants. This group comprised language teachers (English and isiXhosa as the only two languages offered in the schools under study). Convenience sampling was adopted as the chosen primary schools were easily accessible and in close proximity to where the authors are working. We used various strategies for locating and recruiting sites which conveniently fulfilled the data needs of the study, mindful of the question of an ongoing redeployment process of teachers and rationalisation of schools in the Eastern Cape Province. This is a snowballing strategy, for it produced a pool of possible sites for us to conduct research (Boland, 2010; Fick, 2014).

Instruments

Data were collected through semi-structured interviews as they allowed engagements in a dialogue through individual interviews whereby initial questions were modified in the light of the participants' responses making us to be able to probe interesting and important areas which arose (Brinkman, 2013; Seal, 2015).

As semi-structured interviews offer access to personal experiences, interviewees were given some flexibility when responding. This exercise provided researchers an opportunity to probe into teachers' personal experiences; and provide an opportunity to identify patterns of similarity and experience. The group of teachers who embarked in this exercise were those who were teaching languages in grades four to seven. Role played by the library to promote a culture of reading among learners was the key focus being addressed by the authors throughout the interview. As participants gave permission, all the interviews were recorded and later verbally transcribed. The entire activity took place in the schools with the use of English language for both questions and responses.

Data Analyses Techniques

Content analysis as an inductive and iterative process of qualitative studies was used to analyse data, whereby the authors looked for similarities and differences in the text that later

on corroborated or “disconfirmed” theories (Fick, 2015). Spoken communication as recorded data was then systematically described, evaluated and interpreted. The authors examined patterns in communication in a systematic manner. At that point we were already starting to identify the main points or ideas. We then divided up responses into smaller, meaningful units which were later grouped to form the themes (Miles & Huberman, 2014).

Findings

The finding was that all teachers regarded a library to have an important role of promoting a culture of reading among learners. The library had simply never engaged in activities that promote a reading culture to the schools around the district. Even if marketing was done, such a centre was not accessible since the schools studied are located in rural areas very far away from the town where the library is situated.

One participant when interviewed on how often they visited the library in the district, to get assistance on improving reading proficiency on learners, voiced out own opinion:

I do not see the utilisation of the library in the district as connected to the local identity of the school where I teach as I rely on material available at my school. My desire to use that resource centre can be reinforced if the library can market itself for all people in the community in order to raise awareness. Librarians are supposed to visit our schools at least once in a month.

The finding above is agreed upon by one teacher participant when reporting that:

In our belief, as we often stated that the learners we teach have difficulties in reading, applying the strategies as suggested by the libraries and the utility of mini-libraries situated in our schools would naturally equate to readability and communicability amongst the learners we teach.

Another teacher, on the other hand, admirably indicated that,

I decided to create my own mini-library at the corner of my classroom, however ill equipped it is. During break time on a certain day I observed a group of learners from another grade giggling beside the door to my class. I called them to ask what the issue was, only to discover that they requested to enter my class, sit at the big nice mat placed in the library corner, and be given permission to read the interesting story books. These learners mentioned that learners from my class had narrated to them how nice and interesting it was to read a nice story book that made them laugh or wonder, and also how they enjoyed sitting in the beautiful mat bought for them by their educator.

This finding indicates that there are no libraries as resource centres in some schools. Another finding is attributed to lack of suitable reading material. These statements are made by one teacher when reporting:

There is just no library as a resource centre at all in the school where I teach. I rely on using the least books that I have in my cupboard. This simply means my mini library is not appropriately and fully resourced. The only one library as a resource centre for the whole district is far away from our schools. If we may decide to take the learners there for learning purposes, that would be so costly as the school where I am

teaching is approximately forty-five kilometers away from town, where the library is located.

The finding that is attributed to lack of suitable reading material is also evident as another teacher concurs that:

Learners had neither read any non-fiction nor story books when away from the school where I am employed as an educator because of the lack of reading materials at the learners' homes. Learners in my class only depend on the books that I give them to read at school. At a certain stage I gave my learners books to read whilst at home, only to find out that those books get lost, the remaining few submitted back in a very ragged state. The book is not treated as a precious source of information. I then decided to keep safe the books in my cupboard, only to be read while in class.

Discussion of findings

Out of the data collected, it was revealed that the library that is situated in the district is evidently not utilized by most learners. This may be owing to lack of awareness of the library situated in the district. Another lack of awareness factor could be logistical challenges that can be attributed to transport and proximity to the resource centre, since most schools included in the study were situated in far-flung rural areas. The use of library and information resources enables learners to become effective information seekers. However, only a small percentage (7.2%) of schools in South Africa have functional school libraries. Most of these schools are located in historically white, coloured and Indian communities, very far from where rural schools are situated, whereas in disadvantaged black communities school libraries are virtually non-existent. In cases where they do exist, they are non-functional (Hart, 2013).

Some schools in the district had no libraries as resource centres at all. Even those schools with libraries did not seem to make maximum use of such resources. This may be owing to the fact that these libraries are not appropriately and fully resourced. In short there seems to be limited accessibility to the library that is situated in the district due to the lack of library awareness among communities, injustices of the past, lack of motivation from library authorities and the DoE which trickled right down to school communities (parents, teachers and learners). As mentioned in the introduction, little is known about school libraries in South Africa (Mutungi 2012). It is evident, however, that there has been some progress in the establishment and recognition of the role of school libraries. South Africa lacks specific government policy guidelines on school libraries.

Lack of suitable reading material for every reading type, need, and interest for all age groups of South African readership, together with the shortage of libraries has been identified by most participants as the most important impediment to fostering a reading culture in South Africa. School librarians play an important role in the education process. They are the ones to make the least available resources worthwhile, for all. To strengthen this assertion, the American Association of School Librarians (2010) in its statement on the school librarian's role in reading, states that as librarians are equipped with a deep knowledge of the wide variety of authentic reading materials available in the school library and beyond, the school librarian has a key role in supporting print and online reading comprehension strategy instruction in collaboration with classroom teachers and reading specialists.

In this instance, findings from the analysed data on the role played by the library are acknowledged by Hyoky and Kyllonen, (2013) who discovered that the scarcity and accessibility of reading materials in some schools in the Eastern Cape province of South Africa is another significant handicap to the reading culture. The only available libraries, though ill equipped and poorly furnished, are mostly located in secondary schools, higher learning institutions and universities. This indicator seems more accurate than economic or social status, and has implications for all developing countries, including South Africa. The study concludes that the key to success lies in teaching learners how to read, and then having them read as much as possible. Similarly, the findings of a study by Krashen (2014) reveal that a well-stocked library can balance or can make up for the effects of poverty on reading achievement.

Hussain (2018) acknowledges that among many roles of libraries, they provide leadership and expertise by using information and its affiliation technology, which plays a role in teaching and learning process. The libraries provide equal opportunity for all readers regarding information and ideas which are affiliated with some educational institutes as well to public library unimpeded by culture, caste, creed and social constraints. Libraries are playing an important role in the achievement of students at their academic level in the lifelong learning process of the individual. Libraries provide a lifelong learning process. In short, education and libraries are interdependent on each other. Education without libraries and libraries without education are paralyzed (Hussain, 2018). In addition, Marton, (2015) found out that availability and accessibility of relevant and appropriate books and reading materials are the precondition and basis of all reader development activities.

The aforementioned arguments fall within the theoretical framework (Vinz, 2015) of the study as it explores new ways of engaging with texts as suggested by the libraries. Librarians play a vital role with regards to assisting learners to comprehend with the text. It is the duty of the library staff to assist clients. In this regard, clients, being learners, are taught how to peruse books or whatever sources so as to gather as much information as required. People who are responsible for performing this task at school level are, however, mainly teachers.

Conclusion

It is therefore not easy for the general public to access varieties of reading material. This limitation slows the development of a strong reading culture. Research has verified that opportunity to read or the availability of books plays an important role in awakening reading interests, and thus, the number and type of books read are determined to a great extent by the reader's book environment. Learners need to be exposed to a wide range of materials. Proficient reading is reflected in academic improvement as well as fluent speakers who can read effectively and efficiently for a wide range of purposes; such that reading, as one of the basic skills in the learning process, can be instilled in learners for lifelong proficiency.

Recommendations

Although the findings of the current small study cannot be generalised to apply to a wider population because the investigation covered a very low percentage of the Eastern Cape schools, the results could imply that there is a shortage of library resources in rural schools in South Africa as a whole. An intervention strategy could be embarking on marketing campaigns initiated by library authorities so as to sell the noble idea of a good reading culture to learners and all stake holders in the educational system.

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EXAMINING ADULT LEARNING WITHIN LESOTHO'S CORRECTIONAL FACILITIES: CHALLENGES AND BENEFITS

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Abstract

This paper investigates how adult learning in Lesotho's correctional facilities occur. The paper further outlines the challenges and benefits of providing education in Lesotho's correctional facilities. The paper was underpinned through human capital theory, which is defined as an Investment in Human Beings to interrogate the data. Interpretive paradigm using qualitative approach was engaged. The participants for the study were purposively selected for the interviews. The data collection methods were individual interviews with correctional officers and data were thematically analyzed. The findings revealed that education provided is basically literacy and numeracy sessions that are inconsistent and happened on a small scale. It was also revealed that only convicted offenders were engaged in some forms of vocational skills training while those awaiting trial that sometimes spend years on remand are however excluded from vocational skills training. Furthermore, it was found that there were shortages of teachers, classrooms and books in almost all the correctional facilities where education is provided. It is however widely acknowledged that education provided in correctional facilities empowers offenders with life, free enterprise, and self-employment skills. It is recommended that relevant and effective policies should be developed to create mandatory education for all offenders in order to equip them with the skills and knowledge. That could help them to take care of themselves and their families and become responsible citizens and reduce the high incidence of recidivism among offenders.

Keywords: *Adult learning, correctional facilities, offenders.*

Introduction

Many people argue that the provision of education for inmates in correctional facilities is a waste of national resources because most law-abiding citizens are not able to afford education and other basic facilities and services. A counter argument to this is that, it is in the interest of society that inmates in correctional facilities are provided with education and skills for them to be able to live their lives and contribute to the development of their communities and their nations after their release from correctional institutions. Nally, Lockwood, Knutson, and Ho (2012) and Duwe (2017) note that the rate of incarceration since the 1980s has been increasing whereas it has been noted also that offenders are apt to be uneducated and under employed prior to being admitted into prison (Bennet, 2015). Moreover, literature (Vacca, 2004; Setoi, 2012; Johnson, 2015; Ngozwana, 2017) indicate that a sizable number of ex-offenders remain unemployed because of the lack of education and skills required to meet job demands. Meanwhile Pryor and Thompkins (2013) and Jules-Macquet (2014) draw attention to the importance of education and training of inmates in correctional facilities and the measurement of on the basis of their successful reintegration post-release. The importance of providing education for inmates in correctional facilities has been noted by Hawley, Murphy and Souto-Otero (2013) and Vandala (2019) to include: Access to education and training as a right for all; reducing the cost of crime; the role of education in promoting rehabilitation; educational/skills profile of the prison population; and education and training for employability. There is perceived relationship between (a) correctional education (b) an increase in public safety perception, (c) decreased recidivism rates and (d) employment opportunities of ex-offenders (Chappell, 2004; Pryor & Thompkins, 2013; Steurer & Smith,

2003, Duwe, 2017). Lesotho, just like other countries, has a growing number of inmates in correctional facilities that are provided some form of education and training. This paper investigated how adult learning in Lesotho's correctional facilities occur. The paper further outlines the challenges and benefits of providing education in Lesotho's correctional facilities. The participants responded to the following questions:

- How is adult correctional education being developed and implemented?
- How is adult correctional education benefitting the incarcerated offenders?
- What are the challenges regarding adult correctional education for incarcerated offenders?

Theoretical Framework

This paper is underpinned by the Schultz's (1961, 2002) human capital theory which he defined as an "Investment in Human Beings". Human capital theory places emphasis on the importance of education to the participation in the new global economy. He argues that both knowledge and skill are a form of capital and that this capital is a product of "deliberate investment" (Schultz, 2002 p.12). Again Matei and Ceche (2018) opine that human capital consists of those individuals' abilities and those remain the same in any social environment. In this case, the offenders' skills and abilities are placed at the centre in their learning process, which is meant to improve their lives for the better (Pettinger, 2019). Schultz's view about human capital differs slightly from Blair's (2018) who posits that individual income is the result of "human capital". However, human capital gains according to Gaes (2008) specifically are what educators call achievement gains and are presumed to give the student a skills advantage. Some of the skills advantages include generic such as the ability to understand and execute printed and written instructions usually referred to by educators as literacy. The second advantage is skill specific, such as learning carpentry, sewing or computer skills. By gaining some kind of certification such as a school leaving certificate which signals to potential employers what the certificate holder is capable of doing on the basis of the completed work. This advantage may help to combat the signalling "penalty" accompanying prisoners into the labour market resulting from a spell of incarceration (Western, 2007). Schultz (1961) proposed the human capital theory, which he defined as an "Investment in Human Beings". Human capital theory places emphasis on the importance of education to one's ability to meaningfully participate in the new global economy. Becker (1994) similarly confirms that human capital is a form of investment by individuals in education up to a point where the returns in extra income are equal to the costs of participation. Becker (1994) and Pettinger (2019) add that human beings are important repositories of capital as schooling can raise earnings and productivity mainly by providing knowledge, skills, and a way of analyzing problems.

This theory is relevant to the provision of education in correctional facilities in Lesotho. It emphasizes that the development of skills is an important factor in production activities and that it is widely accepted that education creates improved citizens (in this case, inmates) and helps to upgrade the general standard of living in a society. Lesotho is a poor country with very limited natural resources apart from water and some diamond deposits. The human capital resource of the country is one of its key assets it relies on for the nation's development as well as a number of Basotho using their skills to work in neighbouring South Africa. It is widely acknowledged that there is high incidence of recidivism among ex-offenders and some of the reasons normally advanced to this is the fact that most offenders resort to crime because they do not have the skills and education required for them to be employed or create their own businesses. This is sometimes caused by the environment that makes learning difficult (Mkosi, 2013; Johnson, 2015; Ngozwana, 2017; Schirmer, 2008) due to lockdowns,

headcounts, and court hearings that make few inmates to attend thus becoming unproductive. However, providing the relevant education and training for inmates in Lesotho's correctional facilities can help in providing skills they can use to eke out living which can as well reduce the incidence of crime and recidivism among ex-offenders in the country.

Methodology

This study used interpretive paradigm, which provides an understanding of a social phenomenon through the perspectives of people who make meaning out of their reality (MacMillan & Schumacher, 2010).

Research Approach and Design

Qualitative approach (Savin-Baden & Major, 2013; Chilisa & Preece, 2005; Leedy & Ormrod, 2014) was engaged with participants who were individually interviewed while others participated in a focus group discussion.

Instrument and Pilot-Testing

The researcher used a semi-structured interview guide for data collection. Correctional facilities are highly security-controlled environment therefore the researcher communicated the research needs to the correctional officials who served as liaisons in the study. Furthermore, the instruments were pilot-tested with four ex-inmates with the assistance of the correctional officers who liaised with the released individuals. They were located within the nearby community where the institution was located. There were no amendments made to the instrument after the testing.

Sampling Procedures and Sample

For this reason, purposive and convenient sampling methods were used to select males, females and youths who participated in educational programmes. However, the findings presented in this paper captured only the responses of the nine officials who served as liaison officers and were all individually interviewed in the five correctional centres.

The interviews were held in Sesotho, a vernacular language understandable to all participants. Later the transcripts were completed in English language. The management of correctional centres were requested to select correctional officials who were directly involved in the educational activities of the inmates. Thereafter the latter were approached to ask for their informed consent about whether they wished to participate in the study or not by responding to these three questions.

Data Collection

Non-participant observations at five different correctional centres where the study took place were conducted and field notes recorded. Observations looked at where educational activities were happening, while all the undertakings were recorded as field-notes. Additionally, teaching and learning methods, strategies, interactions and instructional details (time; mode; length of activities) were noted. Resources in the form of support provided, materials such as books, teaching materials for teachers/educators; learning materials for inmate-learners were observed including the training sessions of how both female and male adults were equipped with vocational skills at the correctional centres in Lesotho. Furthermore, the method of instruction that is used to impart the skills and knowledge to the inmates and the engagement and involvement of adult inmates in whatever they were learning was observed. The availability of training materials, and the duration of trainings were observed.

Data Analysis

The data were analysed using qualitative thematic analysis. Recordings were reduced to text through transcriptions. The transcripts were read for several times for further understanding of the responses; themes and patterns were identified in terms of how adult learning occurs, the challenges and benefits of correctional education within the institutional centres.

Ethical Considerations

Four principles of ethical conduct for research with people that were observed were in line with the Nuremberg Code of 1947/8 (Office for Human Research Protections (OHRP), 1949) and the Helsinki Declaration (World Medical Association, 1964). These are confidentiality; anonymity, privacy and voluntary participation and right to withdraw, formed part of all research instruments, and were repeated at the beginning of each interview for each participant/interviewee and for the focus group discussions. One can only reach confidentiality, anonymity, the right to participate and withdraw between research participants and the researcher in a normal free-world. Contrarily, in correctional facilities, such principles are highly controlled, compromised and affected by various factors. While the inmates have rights and such rights are protected and enshrined within the Constitution Government of Lesotho (GoL) (1993) there are certain limitations to them (Luyt, Jonker & Bruyns, 2010). However, the right to protection that is based on the ethical principle of beneficence (Ovbiebo, 2012) was highly observed.

Findings

The findings are presented following the three objectives that the study intended to gain, regarding the deeper information from the participants of the study. Where necessary, the direct quotes are stated as evidence to support the data. The first objective looked at how adult learning occurs in Lesotho's correctional facilities.

The correctional officials reported that they volunteered to teach and guide the inmates' learners who seemed interested in continuing and furthering their studies, as well as those who were the first time learners in terms of acquiring of literacy and vocational skills. One Correctional Officer in correctional Centre A stated that the majority of sentenced inmates were illiterate. He further showed that they teach them how to write, read their names and how to calculate numbers. He referred to what was happening as literacy sessions, which he said were informal and did not happen daily. Another official still in the same centre reiterated to say:

These inmates learn from each other, particularly from those who have various vocational skills. I personally do not teach but avail myself just to supervise them and facilitate that work should be done. Those who are interested to learn are free to do so as it is not compulsory. However, these six inmates (pointing to his left hand side where about eight inmates were sitting in front of the hand sewing machines) are full time based in this workshop and perform the work daily.

A follow up question was asked as to how those six were chosen and the time they have spent being in the workshop. The second official in Centre A alleged that only the inmates who were serving their long sentences of over ten-year period were assigned in that workshop. He echoed that, of the six inmates, one has served for 18 years being the longest, while others have served for a period between 10 and 16 years.

In Centre B, an official revealed that there was no formal school for the inmates, but the latter teach one another about literacy skills, meaning reading and writing. An official indicated that the inmates do that on their own just to keep themselves busy. She stated that the inmate learners were interested at learning the employment skills such as vocational skills of sewing, knitting and making bricks.

Three inmates were observed in a sewing room while patching the trousers in Centre B. One of the three inmates was making a trouser pattern using paper. A researcher asked about the supply of materials, where they got it and how often and what they do with the finished products. An official responded saying “we get the supply from some NGOs and one government office. They supply us with cloth.” She reported that they concentrate on sewing the inmates’ trousers and shirts, which is their uniform. She said some inmates wear torn clothes, therefore were supplied with clothes after a while. She told the researchers that most of the inmates patched their trousers because they do not have enough clothes. However, she mentioned that very few people from the society would bring their torn clothes to be mended by the inmates for a little cost.

Centre C showed a different scenario. Four inmates were taught in a formal classroom by one male official. This official was providing a lecture, standing in front of the class and writing notes on the board while disseminating information orally. The inmates’ learners were writing notes inside their notebooks and were less participating in terms of responding to questions that were asked by their teacher. In center C, teaching displayed a traditional formal school where students were copying notes from the blackboard. All the inmates were males and were wearing their red jerseys and khaki trousers. They sat on the student desks and chairs in a row: two in front and two behind. There were six empty desks. After a few minutes, the teacher stopped and gave the inmates a break to go out and smoke. Then we interviewed a teacher who shared his views as follows:

I teach two classes as a volunteer because I am a trained teacher even though I work as the Correctional Officer. I teach geography and science to nine inmate learners who are in grade 8 and six in grade 9. The rest of the inmates in this grade 9 class have gone to attend their remands and one went for his court hearing. This year five of our learners will be sitting for the Junior Certificate Examination (JC is equivalent to grade 10). Since we have not registered as a formal school, our learners write with the juveniles in Maseru District because the centre has officially registered with the ministry of education.

A follow up question was asked: where do you get the textbooks and the school equipment if you are not registered officially? An official postulate that:

We had connections within the ministry of education where certain people donated these desks and chairs to the Centre three years ago. We got the notebooks from the juvenile Centre in Maseru because they have a budget for school stationery. They consistently get the school support from one donor organization. Therefore they usually ask for more to cater for other Centres. The committed inmates gain a lot of knowledge, though it’s an insignificant number of them. We have about 284 sentenced inmates but about twenty are engaged in formal studies. Some of those who seemed interested expressed

their concern that it is of no use to learn because they already had a criminal record, which will negatively impact on the rest of their lives as no one can employ or recognize them after serving their sentences.

A question was asked as to how many officials were engaged as teachers and whether the inmates were doing all the subjects that were similarly done in the public schools. He indicated that the other member who is also a volunteer went out escorting the absent inmates who went to court. He indicated that the inmates were following the syllabus that is learned countrywide by all other schools. He stated that the difference is that the inmates do not do all the subjects at once. Instead they sometimes do two or three subjects in a year. In his words:

Our learners take a long time before they can pass one grade. This is because they do a few subjects in one year – two or three for others. They are not in a hurry because they learn while they still serve their sentence, which for some we talk of over ten years. Anyway, they are trying their best to learn.

In Centre D, there were no educational activities going on as stated by the two Correctional Officers. The first member said the inmates were less interested because already they had a criminal record and therefore no one could employ them or take them seriously for anything. He however indicated that the majority of these sentenced inmates were illiterate, with an exception of a few who went up to basic primary level. He told the researchers that the inmates were not involved in education but instead performed duties that were assigned to them, which involved occupational work of making bricks, sewing, knitting and looking after animals such as pigs, dairy cows and sheep. The second official echoed the same sentiment saying that the inmates were not attending any formal school. He said that what they learn from other inmates were quick-fix skills because he said the skills were used to fix things for the institution. He said:

For instance if the window glass is broken, I just call one or two of them to come and fix the window for us. In that way, they learn from those who have the skills of fixing the windows, in case they happen to be together. Actually it is common say that we teach the inmates the skills for employment. What we do is to pair the ones who know about certain skills with the ones who do not know. We do that with the hope that those who do not know will learn from their fellow colleagues. When we make them look after animals, we also ask for those who have the knowledge of rearing such animals from the past. Then we ask them to regularly feed the animals, keep and take care of them. We also pair the known together with the unknown, with the hope that the latter will practice the skills, using the experience of those who know. That is how these inmates learn. Even in the main district of Maseru, I have been there working for several years. The inmates learn from the experienced inmates.

He further explained that inmates were based for a long time doing one skill simply to perfect their skills while learning from the knowledgeable ones. He stated that inmates do not rotate, unless they are about to be released when they were assigned to do work outside the prison environment. He indicated that the newly arrived / sentenced inmates are not allowed to work outside the prison environment/ premises.

An official in Centre E indicated that the inmates were engaged in literacy sessions where they taught one another how to read and write. He also mentioned that those who were interested to further their studies were allowed and there were three inmates volunteers who taught the others. He however, revealed that the inmates also learn about brick making, vegetable growing, knitting, sewing and keeping animals like pigs, poultry and sheep. He further mentioned that inmates are given vocational skills to enable them for getting employment or being self-employed when they are released from the prison. An official indicated several challenges that are discussed in the next section below.

Challenges of Providing Education in Lesotho's Correctional Facilities

Several challenges were stated by almost all the officials in the five different centres. In Centre E, it was stated that the inmates also learn about vocational skills, but they were not provided with certificates since the skills acquired were not accredited by any institution. Also what came out was that the inmates take any period that is convenient to them, meaning that some learn about one skill for their entire sentence as long as they were comfortable, even if they were to stay for fifteen or twenty years. That indicated that there was no completion of the skills.

In centres B, C, D and E a concern was raised by the officials that there was shortage of materials to use. The officials indicated that the inmates spent most of their time patching their trousers and other clothes instead of sewing new products because of shortage of materials. They further indicated the shortage of resources such as books, pens, no classrooms and lack of trained teachers. They indicated that inmates depend on other volunteer inmates who taught them how to read, write and compute numbers. He said even if the officials would buy into the idea of teaching the inmates, the major challenge remained as shortage of staff, untrained staff and the lack of classrooms for use.

An official in Centre C stated that "routine" is also a challenge because when it is time for the inmates to attend to their court cases, they do so and they miss out what was taught during their absence. He further indicated that what comes first in the correctional centres is the security issue therefore, education was not given a priority. He indicated some shortages of materials such as text books, pens and other things to use. He also stated that the environment was not conducive as it was very cold in winter inside the containers, while it became very hot when in summer. He showed that there was no heating system to control the harsh temperatures that were experienced. He stated that he sometimes knock off early due to the time of locking up, which is done as early as three o'clock every afternoon. It was revealed that the inmates who were still on waiting trial were not allowed to perform any of the educational activities, whether, formal, non-formal because of their status which is not clear. It was mentioned that since they were waiting for trial, they were regarded as innocent and therefore, were not entitled to any of the programmes that were intended for the convicted inmates.

Despite the challenges mentioned, there were also benefits that were identified as a result of engaging in educational activities by the inmates as indicated below.

The Benefits of Providing Education in Lesotho's Correctional Facilities

It is however interesting to note that despite the challenges stated by different officials, there were benefits for providing education within the correctional centres. The fact that education is empowering cannot be overemphasized. The officials indicated that the inmates gained a lot of knowledge and skills from what they learn in the centres. They showed that some

inmates gradually changed their behavior and attitude after joining the literacy sessions. It was also stated that the inmates learn about employability skills that may assist them to become self-employed or be employed by other people in a business enterprise.

The officials also reflected that some of the inmates displayed a changed personality after engaging in learning for some time. One of the officials in Centre B lamented:

Due to the noticeable change in their attitudes, some even get the parole, which means the time of serving their sentence is cut by several months.

Another official indicated that there is a noticeable change of attitudes for inmates who are participating in formal education as compared to those that were not taking part therein. He reiterated that most inmates who were attending school showed more attributes of being responsible – they voluntarily teach other illiterate inmates, they also take the lead in performing the work allocated duties and ensure that all equipment is kept in a safe place. In his words he said: “there is a difference between those that are learning and the way they behave.” He however, showed that the majority of sentenced inmates who come from the rural areas were less interested to join formal classes, but engaged mostly in vocational skills training. He said he assumed that the reason may be that they were old, and have not been to school at all. He stated that the inmates from the urban areas were the ones interested in formal learning but were less interested in vocational skills training.

Moreover, it was stated that engaging in different learning activities was beneficial as it kept the inmates busy from boredom and idling. He further noted that chances for these inmates to easily engage and interact with other members outside in their communities were higher due to their element of confidence and self-acceptance.

Discussion

The findings revealed that the type of education that is provided within Lesotho’s Correctional Centres is basically literacy and numeracy skills sessions that are inconsistent and happened on a small scale. It was revealed that only the convicted offenders were engaged in vocational skills training while those awaiting trial inmates who sometimes overstay for years on remand were excluded from the skills training, thus supporting findings by Vandala (2019). These inmates participate in different vocational skills with the hope that they might get employed or work as self-employed people upon their release from prison. This is confirming what Becker (1994), Pettinger (2019) and Schultz (1961, 2002) stated when referring to human capital as a form of investment where individuals engage in education, which will earn them returns in the form of extra income at a later stage. The findings outlined that the inmates learned through experience from those who were skilled in performing activities such as sewing, bricklaying and rearing of animals. However, an exception was with one centre where formal education was performed and the traditional teaching was done by officials. While it was mentioned that those inmates who seemed interested gained a lot of knowledge from what they learn, several challenges were stated by these officials.

The data revealed that the challenges within the correctional centres regarding the inmates’ education included shortages of teachers, classrooms and books in almost all the correctional facilities, which affirms literature (Mkosi, 2013; Johnson, 2015, Ngozwana, 2017). Moreover, the inmates were not graduating from the skills training as they performed those skills non-stop until their time of release. For some inmates, it was noted that they took a long

time to complete what they were learning due to inconsistencies that were felt. Such included their absence from what they were formally learning as a result of attending court cases, hearings (Mkosi, 2013; Johnson, 2015; Ngozwana, 2017; Schirmer, 2008), routine which include security issues of lockdown, change of shifts and probably escorting inmates to health centres, and consulting with their lawyers during the learning time.

The data indicated that when the inmates were released from the centres, they were not issued with certificates because of lack of accreditation of the acquired skills. This implies that the inmates' skills were not recognized, thus making it difficult for them to be employed in any industry upon their release. It was reported that inmates performed the vocational skills just to keep themselves busy out of boredom. Other inmates showed no interest to learn due to having criminal record that would not accord them any chance of getting employment from anywhere thus supporting Duwe (2017). The implication is that inmates could delay to be rehabilitated due to their negative attitude and lack of motivation to engage in activities that are specifically meant to empower and develop them to change their lives and live a crime free life as attested by literature (Chappell, 2004; Pryor & Thompkins, 2013; Steurer & Smith, 2003; Pettinger, 2019).

It was mentioned that even though there were benefits regarding the offering of education within the centres, there was a need for increasing the resources, and including the review of existing practices and policies, which do not place education as a key priority in the institution. From the data, it can be realized that education provided in correctional facilities empower offenders with life, free enterprise and self-employment skills. It also facilitates for smooth social integration for inmates within their community members and society in general.

Conclusion and Recommendations

While it is acknowledged that education provided in correctional facilities empowers offenders with life, free enterprise and self-employment skills, it is recommended that relevant and effective policies should be developed that can create mandatory education for all offenders. This could equip them with skills and knowledge that can help them take care of themselves and their families and become responsible citizens as well as reducing the high incidence of recidivism among offenders.

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EXPLORING AN APPROPRIATE CONTINUING PROFESSIONAL TEACHER DEVELOPMENT (CPTD) MODEL FOR RURAL TEACHERS: A CASE OF CHRIS HANI WEST RURAL SCHOOLS, EASTERN CAPE

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Abstract

Drawing from the research that assessed the implementation of Continuing Professional Teacher Development (CPTD) in Lady Frere, this study explored a most appropriate CPTD model that could be used in Chris Hani West (then Lady Frere circuit) for developing rural teachers. A professional teacher development model needs to be a powerful tool to support better classroom practice and learner performance. Studies indicate that teachers, as adults, need to choose their learning opportunities according to their interest and considering their own classroom practice and needs. Furthermore, a well-designed collaborated attempt is one of the important features of a well-planned teacher development programme. Nevertheless, it appeared from existing research that little had been researched on getting a most appropriate rural teacher development model that would result in teacher change and better learner performance. In this paper, we explored the implementation of professional teacher development of rural teachers in Chris Hani West Education district. A mixed-method design was adopted where a sample of fifteen Grade 11 teachers from fifteen out of eighteen secondary schools was purposely selected (one from each school). To collect data, concurrent procedures were used where face-to-face self-administered questionnaires were given to each Grade Eleven teacher and Heads of Departments, with permission verbally granted by the principals of schools in the sample. Interviews were conducted with five randomly selected teachers and Heads of Departments in the circuit. Quantitative data were analysed through frequencies and percentages while tape-recorded qualitative data were summarised into themes and concepts and linked into similar categories. The aim of this paper was to explore a most appropriate model that would lead to powerful professional learning and improved learner performance. The authors, therefore, studied interview responses from the participants and tables indicating the responses from questionnaires. The responses from both instruments assisted the authors to determine the most appropriate model for teacher development programmes. The findings of the exploration indicated that teachers do not approve of the models of professional development offered by education officials. The few responses from both research instruments used in the study attest that teachers were not pleased with the development models to which they were exposed. Having consolidated the findings, it is recommended that the best development model to be used for rural teachers should be communities of practice.

Keywords: *Continuing Professional Teacher Development, rural district, communities of practice*

Introduction

Awareness and focus on Continuing Professional Teacher Development (CPTD) has been having a growing focus throughout the world (Fraser, Kennedy, Reid & McKinney, 2007). This focus has been attributed to the recognition and enhancement of policy agenda of lifelong learning and of improving learner performance (Fraser et al., 2007; Coolahan, 2002; Schwille & Dembele, 2007). Existing research indicates that an inspired and informed teacher is the most important school related factor influencing learner performance (Bridge, 2017).

Hence, continuing professional development of teachers is important because education is an ever growing and ever changing field (Teacher.org, 2019).

Research specifically demonstrates that if teachers' competence improves, the first learners to profit are the poorly achieving ones (Bridge, 2017). This clearly suggests that the teacher's knowledge and skills are the most significant factors in learner performance and achievement (Bridge, 2017), which means that improving teacher performance is about improving student learning. Research has also indicated that South African rural schools do not perform as expected (Mashologu, 2012). Therefore, it has become critical that close attention be paid to how new and experienced teachers should be trained, developed and supported (Bridge, 2017). According to Darling-Hammond (2017), teachers' learning is not complete when teachers leave pre-service preparation alone. This becomes critical in the case of the majority of South African teachers whose learning was inferior and inequitable before 1996 (Chisholm, 2004).

Subsequently, schools need to prepare for this uncertain and dynamic future by equipping learners with knowledge and skills that they would need. On the other hand, teachers are not developing pedagogies and practices required to meet the diverse needs of the twenty first century. Hence, according to (Garet, Porter, Desimore, Birman & Yoon 2001) it is clear that improved teachers' skills and knowledge is one of the best investments. Hence, this paper has advocated for improvement of teachers' skills and knowledge by availing a wide variety of professional development options.

Moreover, it is important to note that delivery styles and personality types attend to these aspects in different ways and varying extents. This is further explored by Fraser et al. (2007) who state that where the purpose is transmissive, development models are mostly centralised and focus on technical aspects of the job (Fraser, 2005) as cited in Mashologu (2012) rather than change of values, beliefs and attitudes (Sprinthal, Reiman & Theis-Sprinthal, 1996). However, a transformative model can be associated with affording teacher autonomy where teachers can be professionally independent to an extent of improving their own classroom practice (Kennedy, 2005). Hence, the purpose of the paper is to explore an appropriate continuing professional teacher development model for rural teachers in Chris Hani West Education district in Eastern Cape.

Statement of the problem

Research suggests that teachers must be lifelong learners so that they are able to teach each new group of learners. On the other hand, the profession should not only allow teachers to learn new teaching strategies and techniques but also interact with educators from other schools in order to improve their own teaching. This has been difficult therefore, means that on-going professional development is critical for teachers who wish to be great at their jobs and offer the best to their learners each day (Teacher.org, 2019). Edutopia (2019) emphasises that CPTD keeps teachers up-to-date on new research and on how learners learn. However, the best teacher development is the one that is on-going, experiential and collaborative (Mashologu, 2012).

According to Okeke and Mpahla, (2016), to improve effectiveness of CPTD teacher preferences regarding their development need to be considered by the education authorities. In other words, teachers should choose their own learning opportunities based on their classroom experiences and needs (Karlberg & Bezzina, 2020). Teacher competences have not improved as envisaged, in spite of the attempts made by government and with many

professional teacher development programmes not taking into account teachers' perspectives (Tsoetsi & Mahlomaholo, 2015).

Teacher development programmes that do not lead to change in classroom practice and do not encourage teachers to participate in professional development with others can be termed ineffective (Garet, et.al, 2001). If teachers could be afforded opportunities to engage in a meaningful analysis of their teaching and learning they would get effective development. Moreover, learning by doing has always been the best for adult learners (Wenger, 1998). It is further alluded that effective classroom practice, because of appropriate teacher development, leads to better learner performance that, in turn, will influence teacher (Guskey, 1986). Hence, the exploration of an appropriate CPTD model for Chris Hani West Education District that would result in the improvement of learner performance in Eastern Cape.

Study objective

The objective of the study was to address the question of professional teacher development by getting a model that would be suitable by drawing from a study conducted on implementation of teacher development programmes.

Literature review

The purpose of both teacher professional learning and teacher professional development is to transform teachers such that they are able to take charge of classroom practice (Mashologu, 2012). The transformative models are about the most effective efforts for change to take place close to the action as they are aimed at the needs and expectations of teachers. Moreover, they are practical, occur continuously and they give teachers the opportunity for professional development, growth and change (Mashologu, 2012).

Furthermore, professional development for registered teachers in South Africa became mandatory to encourage individuals to improve themselves professionally (Steyn, 2013). The main purpose for professional development is to encourage teacher participation and improving learning within the schools. As maintained by Appleby and Pilkington (2014), Brown and Engelhardt (2015), professional development is an asocial, discursive and reflective process that is situated around practice and leads to teacher change. This teacher changes according to Guskey's theory (1986) is the result of staff development that leads to change in teacher's classroom practice, which in turn leads to a change in student learning outcomes, after which teachers' beliefs change.

New approaches, as suggested by Wenger's (1998) social theory and adult learning, to professional teacher development are encouraging and demanding that teachers should learn with and from colleagues in their communities of practice. This model affords them time to reflect critically on their daily practices and to enhance their capacity to understand their complex subject matters from the perspective of diverse learners (Day & Sachs, 2004; OECD, 2016). As posited by researchers, professional teacher developments need to shift from only supporting teacher's acquisition of new skills or knowledge but to providing occasions for them to reflect critically on their practice and to fashion new knowledge and beliefs about content pedagogy and learning (Darling-Hammond & McLaughlin, 1995). On the contrary, Pianta, Decoster, Cabell, Burchinal, Downer & Howes (2014) indicate that communities of practice provide teachers with feedback on newly implemented practices or strategies.

Okeke and Mpahla (2016) support the idea of communities of practice. The scholars confirm the inappropriateness of teachers' strategies for CPTD programmes and indicate that they do not influence their classroom practice. They prefer their own communities of practice as supported by Lauer, Christopher, Firpo-Triplett and Buchting (2014) and Robinson (2015) that communities of practice provide teachers a chance to reflect and assess themselves on recent practices in their classrooms. As confirmed by Goodall, Day, Lindsay and Muijs (2005) knowledge and skills are better learned in contexts that reflect how knowledge is obtained and applied in everyday situations.

In spite of numerous teaching programmes offered to teachers, relatively little progress has been made in CPTD (OECD, 2016), whereas education in contemporary spaces needs teachers that constantly advance their own professional knowledge. This concurs with 2003 Trends in International Mathematics and Science Study that showed that South African teachers had extensive development opportunities but the evidence of poor learner performance showed that these had limited impact (DHET, 2014). Moreover, research around the world increasingly supports the idea of investing in quality, career-long opportunities for professional development (Bridge, 2017). Furthermore, CPTD is an integral part of teacher education as it is only continued learning and training that assures a high level of expertise and ensures that teachers keep up to date with new research on how children learn (Bridge, 2017).

International research indicates that teacher networks are considered as one of the best strategies of teacher development programmes (MacNeil, 2004). According to MacNeil (2004), teachers also participate in Teacher Circles, which are groups of teachers from different schools who meet regularly to train each other and share their experiences. Huberman (1993) indicate that teachers learn best when they are active in directing their own learning and when they are focused on concrete tasks that emanate from their daily encounters with learners. Subsequently, as a way of assisting teacher development initiatives, New York came up with a number of models that are about teacher networks (MacNeil, 2004). These models are about resident teachers, teacher consultants, inter-visitation and peer networks as well as teachers travelling off-site to a Higher Education Institution where they would get content specific and time bound training to close whatever content gap that may exist amongst them (OECD, 2016).

Neuroscience learning confirms that people learning through social interaction as learning are better stimulated by a moderate amount of stress (Goswami, 2006) is more effective than being instructed. "Thinking together" is a process that is conceptualised as a key part of a meaningful Communities of Practice where people mutually assist and guide each other through their different understanding of the same problems in their area of mutual interest. In this way, therefore, people indirectly share tacit knowledge (Wenger, 1998). Moreover, this thinking together allows, develops and sustains an invigorating social practice over time (Anderson – Carpenter, Watson-Thompson, Jones & Chaney, 2014).

For effective teacher development that would support complex skills and knowledge and learners acquiring mastery of challenging content teachers' need to be able to employ sophisticated forms of instructional leadership. Moreover, effective professional teacher development is a key component to learners' learning and refining the pedagogies and skills required, especially for the twenty first century, (Darling-Hammond, Hyler and Gardener, 2017). As teacher education is mostly characterised by intellectual silos and recognition, it has been noted that in communities of practice, it is looking beyond one-self that optimises

success. Furthermore, in communities of practice success is encouraged through navigation of collaborative relationships that lead to working and personal relations that are intellectually challenging.

In support of these collaborative initiatives, Rogoff (1998) contends that in a learning community, teachers scaffold one another's learning through a powerful exchange of ideas. Hence, literature on communities of practice is centred around the Michael Polanyi's conception of personal knowledge which leads to an argument that communities of practice come to being from the trans-personal process of thinking together rather than being a community 'set up' (Pyrko, Dofler & Eden, 2016).

Theoretical Framework

The assumption of the study is supported by Wenger's (1998) social theory on adult learning, which asserts that learning is possible if the sense of the subject matter is discovered through collaboration rather than members being informed about. This assumption is supported by Knowles's (1980) andragogic theoretical model that states that an adult learner is self-directed, responsible for their own learning, wants to perform real life tasks to solve problems and wants learning that is collaborative rather than didactic.

Research Methodology

The study adopted a mixed methods design. Data validity, reliability and ethical issues were taken into consideration during the data collection. Data that emphasised the importance of communities of practice were presented, analysed and interpreted. Findings of the study indicated that teachers preferred communities of practice as the best models of continuous professional teacher development programmes by the teachers.

Results

The research sought to establish if HoDs at schools initiated any strategy for teachers that would be related to communities of practice. After probing, responses revealed that the sampled HoDs never introduced models that would be associated with communities of practice because they were not aware of the strategy as stated below:

The problem is that I don't think I know what you are talking about. We used to have subject committees and subject associations which never functioned at all and that is where they were supposed to empower themselves

The response from the HoD indicated that teachers of the circuit were not introduced to any strategy related to communities of practice, as most of the sampled HoDs were not aware of such a strategy.

To verify the response from the HoD, one of the interviewed teachers regarding the arranged teachers' meetings to discuss matters of classroom practice seemed to know something about it although it was according to their different context as indicated by the following response:

We do have these gatherings fortnightly and we use Fridays from twelve o'clock every fortnight. In these meetings we come with our challenges and we discuss new problems that we come across in our classes

Subsequently, another teacher when asked as to which of the development programmes they would prefer. The response was that "... Given a chance I would prefer the one where teachers of the same subject come together to discuss issues of their subject as a way of

developing themselves.” At the same time, another teacher gave a different dimension of collaborative activity as given below:

... I want to be honest. We don't have such meetings in our cluster. When we meet it is only when we have moderations. We don't have those gatherings; we don't share the skills as a result our cluster is always having low matriculation pass rate in the district. If we could be given such opportunities, we would be very comfortable with our classroom practice:

The above statement was confirmed by responses from teachers as indicated in Table 1 in which teachers indicate what they would like to do should they be offered networking opportunities.

Some of the teachers knew nothing about teacher communities of practice but when the model, through probing, was explained to them, collaboration seemed to be what they would go for but it was clearly introduced to them by their Subject Advisors as indicated in the Table below.

Table 1: Activities preferred by teachers in teacher network

Total frequency list of strategies encouraged	Frequency	%
Peer observation	2	40
Participating in groups with fellow professionals	1	20
Forming local groups to discuss teaching and learning issues	1	20
Taking turns to lead collaborative sessions	1	40
Total	15	100

The table above indicates that some of the Subject Advisors never introduced the strategies that would introduce teachers to communities of practice. One of the teachers clearly indicated this point in the statement below:

I think if that could happen it could help us a lot because as teachers we have different abilities. If we could share our ideas with one another, maybe we can develop a lot of skills. It could help when we meet as subject teachers and discuss our issues pertaining to classroom practice and things can be better because some of the teachers were not trained in the subjects that they are handling.

The above statement is confirmed by the responses in the following table below.

Table 2: Activities preferred by teachers in teacher network

Total frequency list of activities	Frequency	%
Peer observation	0	0
Participating in groups with fellow professionals	0	0
Forming local groups to discuss teaching and learning issues	9	60
Taking turns to lead collaborative sessions	6	40
Total	15	100

Amongst those that were interviewed, one teacher informed the researcher that as teachers from different schools, on their own, they informally organised a community of practice as their way of helping one another and explained their idea as follows:

As friends, we meet with teachers from two other districts at Kentucky Fried Chicken (KFC) in town. We meet and discuss topics, questions and lesson plans that will cover a certain area for a specific period of time. Thereafter we discuss challenges that we experience in our classrooms regarding our subjects.

Discussion

A community of practice is not merely a social group but a community whose members are practitioners who are interested in developing a repertoire of resources, such as experiences and ways of addressing recurring problems (Wenger, 1998). According to the results of the study, the authors realised that the regular communities of practice model where teachers meet to discuss matters of their classroom practice can be the best model for rural teachers of Chis Hani West Education district as it would develop their professional learning and development needs that would assist their classroom practice. Moreover, communities of practice also manage knowledge and value diversity to increase individual capacity to manage improvement and development. It is quite clear that communities of practice, in this case, were not encouraged by the district officials. It was an activity that teachers of the district were also not aware of but would prefer if they were exposed to. Surprisingly, this study indicated that there were some teachers who informally organised communities of practice, not because they knew of it to be one of the development programmes but as they thought it could further their purpose, that of assisting each other and grow in their careers in the process.

According to Day and Sachs (2004); in Japan, although the Ministry of Education had continued to require teachers to attend training courses, it had also recognised that:

Teachers will not and cannot be merely told what to do. Subject specialists have tried it ... Administrators have tried it ... Legislatures have tried. Teachers are not assembly line operators and will not so behave. (Day & Sachs, 2004, p. 158).

The implication is that teachers can easily show their capacity of course, if they are given direction beforehand and as adults will work better in a social practice space and will also commit to a development programme that deals with what they want. Communities of practice clearly improve teachers' foundational and reflexive competences as they, together; demonstrate ability to integrate the discrete competences, which constitute each of the seven teacher roles (Mays, 2000).

Conclusion and recommendations

The study indicated that HoDs as instructional leaders, knew nothing about communities of practice as a teacher development programme. For them, planning communities of practice was a challenge because teachers would need to be supervised. Contrary to that, teachers indicated that they enjoyed meeting their colleagues as friends to discuss teaching and learning practices to an extent of informally, on their own, organising communities of practice. This suggests that teachers did not understand the way the development programmes were conducted.

In communities of practice, apart from teachers learning from each other, scaffolding one another's learning through a powerful exchange of ideas, development is based on self-directed work that creates a sense of ownership. This paper has revealed insights from social practice theory through communities of practice, which leads to effective continuing teacher development as teachers enjoy working together. It is recommended that continuing professional teacher development models should be collaborative and enjoyable to teachers

for them to be sustainable. This study also recommends that teacher development programmes be conducted as a means of transforming teachers' classroom practice, as in the case of communities of practice.

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EXPLORING LECTURERS' PERSPECTIVES ABOUT THE USE OF FLIPPED CLASSROOM IN A SOUTH AFRICAN RURAL UNIVERSITY

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Abstract

With the evolving use of technology and progression towards the 4th industrial revolution, universities find themselves under pressure to meet global standards in the provision of education using innovative teaching and learning methods. The flipped classroom is a teaching and learning approach that uses technology to deliver academic content outside the classroom and uses in class interaction for in-depth discussion of the course content. Teaching at a rural university is fraught with challenges which compromise the lecturers' capacity to be creative with their teaching approaches. This paper sought to explore lecturers' perspectives on the use of the flipped classroom in a rural university. The paper adopts the interpretive paradigm and qualitative research approach. Consistent with the paradigm and approach, data was collected using semi-structured interviews with three lecturers purposively selected on the basis that they used the flipped classroom in their teaching. The findings indicate that the major reason for using the flipped classroom was to enhance the level at which students engaged with the content of the module, and to utilise the given lecture time efficiently. Resources such as the learning management system, quizzes, recorded presentations, pre-set questions, were found to play an important role in the flipped classroom. Usage of these varied according to the preference of the lecturers. The paper argues that flipped classroom promotes active student learning in this knowledge society and innovation economy.

Keywords: *Activity theory, Flipped classroom, resources, technology*

Introduction and Background

The purpose of this study was to explore lecturers' perspectives on the use of the flipped classroom model in a first-year education class at a rural University. Siegel (2014) states that technological innovations that have the capability to enhance the way in which students learn, appear every day. Teaching and learning is the core business of universities; therefore, it is imperative that institutions introduce and make use of teaching and learning methods that ensure students learn effectively and efficiently. Technology plays a crucial role in the lives of students in the 21st century and its use in the classroom could prove beneficial for teaching and learning. According to Aycicek, Yanpar and Yelken, (2018), students in traditional classrooms are deemed passive recipients of information. There is one way transmission of information from the lecturer to the students, popularly known as lecture-centered teaching and learning. However, in the twenty-first century, lecturers need to come up with innovative and effective teaching and learning approaches.

The flipped classroom, sometimes referred to as the flip, has various origin stories but its inception is largely attributed to Jonathan Bergmann and Aaron Sams. The two high school chemistry teachers from Colorado, decided in 2006 that they would make use of recorded lectures. The flip came up out of numerous experiments with the concept of hybrid, blended learning and problem based learning; which embraced active learning techniques and advanced technologies to involve students in the learning process (Arnold-Garza, 2014). The model works contrary to the traditional model in which content delivery occurs in a lecture

hall between the students and the lecturer, and where students integrate knowledge by doing homework in isolation after class. The lower levels of Bloom's taxonomy are presented to students prior to the class and they go through recorded lectures and other media provided. Material such as readings and simulations provide the foundation for learning support, so that time spent in class working on the higher levels of learning can be productive (Zainuddin & Halili, 2016). A student-centred active environment is enhanced as the content students learned before class is applied and put into context in the classroom (Nanclares & Rodriguez, 2016; Little, 2015). This approach could prove both possible and beneficial at a rural campus with limited resources, through the use of simple tools that are easily accessible to students.

Although the use of flipped classroom is beneficial in pursuit of the call for integration of technology into teaching and learning, as well as the paradigm shift from lecturer-centred to student-centred teaching approach, there are criticism levelled against this approach (Ash, 2012). Some scholars argue that the flipped classroom approach disadvantages low income students who may not have resources to use off campus; and privileges students who can afford requisite resources such as internet, computers, software and others (Hajhashemi, Caltabiano, & Anderson, 2016). In the South African context, the majority of students who live in rural areas come from low income households (Walker, & Mathebula, 2019). While avoiding to homogenising rural contexts, it is essential to highlights the myriad challenges facing these contexts (Masinire, Maringe & Nkambule, 2014). Literature predominantly describes rural context in relation to urban context wherein the challenges in rural context are flagged. Such challenges include neglect, exclusion, poverty, backwardness, disease and depopulation (Balfour, Mitchell, & Moletsane, 2009). These challenges affect the learning experience of students. Against this background, this paper explored the perspectives of lecturers regarding the use of flipped classroom in one South African rural university. These perspectives are likely to inform higher education about the benefits of using flipped classrooms and the nature of resources that can be used in rural context. The findings in this paper also have a potential to inform policy about the use of flipped classrooms in rural universities since policies are adopted or amended on the basis of empirical evidence. The main research question guiding this paper was: What are the lecturers' perspectives on the use of flipped classroom in a South African rural university? The secondary questions that the paper addressed were: Why do lecturers use flipped classroom in a rural university? What is the nature of the resources used by the lecturers?

Theoretical Framework

We frame this paper in activity theory to understand lecturers' perspectives regarding the use of a flipped classroom. Amry (2018) posits that humans are not just isolated beings, and learning is equally a social phenomenon, because it takes place in an environment determined by culture, and exerting an influence on diverse human groups according to their daily behaviours. Hardman (2005) reports that, for Vygotsky, people utilize instruments to alter the world and are themselves changed through the apparatus they utilize. Activity theory's interests lie in 'who is doing what, why and how.' It gives clarity on human activity. Bligh and Flood (2017) describe this theory as outlining a subject-object framework influenced by interlocking artefacts (whether more or less substantially tangible), divisions of work (whether by mastery or specialist) and rules (whether or not expressly perceived).

Activity theory asserts that activities comprise both the person and social level, as well as the mediational devices and artefacts that form boundaries between the different modes. These devices may incorporate ICT tools that support work capacities among individuals in the learning environment (Lim & Hang, 2003). Lim and Hang (2003) note that when ICT tools

are coordinated into the educational programs, they end up as devices that facilitate teaching and learning exercises to create higher order skills and thinking (objects), with students and/or facilitators as the subjects.

This theory is appropriate to use because the study will look at how the subject (students) and object (flipped classroom) mechanisms have a facilitative relationship on each other through the use of tools. Activity theory posits that actions are meaningless unless they occur within an activity. For students to be engaged in the learning process, this theory is relevant. In its demonstration, a subject alludes to a person or bunch of people (collective) who are the most prominent actors within the activity (Holen, Hung & Gourneau, 2017). Instead of centering on the information states, it centres on the exercises in which individuals are locked in, the nature of the apparatuses they utilize in those exercises, the social and relevant connections among the collaborators in those exercises, the objectives and intentions of those exercises and the objects or results of those activities (Jonassen & Rohrer-Murphy 1999). It would therefore be meaningless to expect students to be involved in the learning process and engage with their content if you just give them study material and ask them to study/read it. The flipped classroom allows for interactive learning, where learning becomes a rotational activity consisting of various facets for the outcomes to be achieved.

Research methodology

The study adopted a qualitative research approach because it sought to understand the perceptions of lecturers regarding the use of flipped classroom. Qualitative research refers to an in-depth investigation as well as explanation of a phenomenon of interest in a certain field. According to Hammarberg, Kirkman and Lacey (2016), methods used in qualitative research assist in answering questions based on participant experiences, meanings, and perspectives. By its nature, qualitative research allows for the description of participants' experiences, either supporting or opposing the theoretical conventions on which the study is founded (Meyer, 2001). This descriptive nature allows the reader to understand and draw meaning from the experiences of the participants, the apparent nature and impact of the problem (Meyer, 2001). The research adopted qualitative inquiry as it sought to explore lecturers' perceptions and views on the usage of the flipped classroom.

The sampling strategy that was used for this study was purposive sampling technique. Three lecturers teaching different modules were selected as participants. They were selected because they used or had used the flipped classroom in their first-year courses. The information they provided was rich owing to their experiences in the actual use of the flipped classroom approach.

Semi-structured interviews were used to generate data. Semi-structured interviews include a sequence of open-ended questions pertaining to the topic and the key areas that the researcher wishes to cover. McIntosh and Morse (2015, p. 2) explain that semi-structured interviews are characterised by a comparison of responses received from participants in response to particular items.

Data was analysed using thematic analysis. According to Braun and Clarke (2006, p.82), thematic analysis is a method for identifying, analyzing, and reporting patterns (themes) within data. It minimally organizes and describes data set in (rich) detail. Data collected from semi-structured interviews was transcribed and organized into themes.

To ensure credibility, a voice recorder was used to record the interviews. This was done to ensure that all the details were captured, as the interview was not limited to the interview schedule questions, but probed deeper into lecturers' experiences. The findings were not generalised since the study was conducted at one rural University.

All necessary processes and procedures were followed regarding ethical issues. Ethical clearance was obtained from the participating university. Informed consent was obtained from the participants who were assured that their participation in the study was voluntary. Anonymity was ensured by using pseudonyms instead of the participants' real names.

Findings and discussion

In this section, we present and discuss the findings according to the themes that emerged from data. In doing so we were cognizant of the importance of observing ethical issues. Thus, we use pseudonyms to refer to the participants.

Reasons for using flipped classrooms

In response to the question regarding the rationale for the use of flipped classrooms in a rural university, the participants provided diverse perspectives. Thabo explained that the contact time given per lecture was not sufficient for coverage of the content. He realised that he could teach the theoretical part but there was usually not enough time to cover the application of the theory:

I and some other lecturers were busy. We did not have enough time or contact time to get through with both the theory of the module as well as the practical application and revision etc. And, especially with the large classes, even one individual cannot afford to fall behind. So one of the key things for me was to kind of get more time to do application and more revision, so typically, in the past, I'd do all the theories in class and then we would give them homework opportunities.

Thabo justified the use of flipped classroom as a strategy to create opportunities for students, not only to learn the subject content, but also to apply the content knowledge. Mary was motivated to use the flipped classroom by her exposure to innovative teaching and learning theories. She then saw an opportunity to use this teaching and learning approach to tackle the more difficult concepts in her modules. She said,

Aaah, because of the benefits obviously. I heard of this approach from the scholarship of teaching and learning group and I saw a need for my students to be more engaged, to engage with the materials especially and focus on what the more difficult activities entails.

It is important to note that Mary saw the need to flip her class in order for her students to become more engaged. The flipped classroom offered her an opportunity to make sure deeper focus on the more difficult tasks.

Edward reported that his decision to use a flipped classroom was informed by his experience as a University student. This is what he had to say,

Okay, ... University where I was a student, we were already using that method of studying or of learning, where the lecturers used this regularly and gave us a bunch of questions beforehand, and we had to go and prepare, find information from the library, create case studies, and then come back and have discussion in class about

the topics and things in advance. I then started using it in my class so much more to see how our students can benefit from that model of teaching as compared to the traditional teaching.

The evolution of technology and the increased intakes have pushed lecturers to come up with alternative effective means of instructional delivery (Carr, 2014). The findings in this study indicated that one of the key concerns for adopting the flipped classroom by participant lecturers was to intensify teaching and learning in a meaningful way that would positively contribute to high levels of knowledge acquisition, which is consistent with the findings from a study by Nanclares and Rodriguez (2016). Even at a rural university lecturers attest that students came well prepared to class, knowledgeable about the content due for discussion on the day, and further prepared to engage in meaningful conversations with the lecturer and peers. This addresses the concern by Gaughan (2014) that lecturers in South Africa are confronted with the challenge of positively influencing the quality of learning offered at institutions of learning. Another challenge is that of influencing students to engage in continuous learning, through incorporation and internalization of relevant material and its delivery through varied methods of content delivery.

Using resources in a flipped classroom

Literature has shown that certain resources and tools are used in the implementation of the flipped classroom. These resources are meant for the delivery of content material outside the classroom, for in class activities. Thabo had this to say about the resources he used in his flipped classroom:

In a nutshell, I broke down the use of resources into three major phases, before class, in class and towards the end of the class. So, before class, I made little screen capture videos, with some animations include characters jumping around and pointing at things. I would make slides and record a narration behind the slides where I would be explaining whatever is on the slides. I tried to design the whole pre-reading activity in terms of videos that they can watch, and if they don't understand something they can always rewind and listen again. I made sure the videos are downloadable from their cell phones. I also used quizzes to give them the fundamentals of what the unit is about. I used the blackboard as a platform to post all these resources and learning material, which they had to go through before class. Towards the end of the class I had what I called exit tickets, where at the end of the lecture, I would pose a higher level application type of question which they needed to apply the theory.

Thabo used various resources to flip his classrooms. The use of these resources facilitated students' engagement before they attended the lecture, during the lecture and after the lecture. In this way, the students engaged with content, fellow students and their lecturer. Interestingly, the videos were edited in such a way that they could be downloaded from cell phones. Thus, students who did not have laptops could still learn when they were off campus. Bergman and Sams (2012) observe that the use of technology is not compulsory when flipping your classroom and can be used if it is appropriate to do so. They argue that the use of technology helps intensify interaction between lecturers and students.

Mary pointed out that in flipping her classroom, she took into consideration the learning conditions of a large number of students who resided off campus.

I mainly use the textbook and, questions. I was wanting to say hard copy material, because the one thing I found is that more than 60% of my students reside off-campus.

So, I did make use of things like, quizzes and all that but I didn't solely rely on them because I know there is different definitions of the flipped classroom. Some or most of them had a technical, online element and is better that way; but mine also had that but I also ask them to prepare a certain part and I think it was reading, watching videos, so it was mainly blackboard and prescribed textbook.

When choosing resources, Mary was conscious of the fact that most of her students lived off-campus and would have difficulty accessing material online.

Edward shared similar sentiments with Mary in that he also believed that flipping the classroom and dissemination of information and study material should not only be limited to using technology. He had this to say when asked about the resources that he used:

I gave them question papers, sets of about 30 questions that are possible questions that I can ask out of the chapter, and then there is the textbook to go through and study each week. They read through the textbook themselves and they can now get additional information, also from the articles, other books; and compare when answering the questions, and then they come to class and we have a 2 hour discussion where we go through the questions and everybody gets the chance to air their input, and we finalize the answer. So, there wasn't really the resources like computers, and anything that needed internet access, unless if they wanted additional info.

Edward used the resources that were at the disposal of the students like Mary, but he did not explain why he did that. I assume it was just a matter of preference and each lecturer did what they saw fit for their module. He however, did not rule out the issue of using technology as he later noted that:

I used blackboard minimally to communicate and maybe post questions and stuff, but no so much that they have to answer the questions there. It was not needed that the technology be there but it can also be used here and there.

The use of use of technology bears some significance in flippedclassrooms. 'In Activity Theory, the relationship between subject (human doer) and object (the thing being done) forms the core of an activity' (Hasan & Kazlauskas, 2014, p. 11). For the activity theory, the primary unit of analysis is the framework of the activity. Briefly, this talks about a bunch of individuals or a community, who share a joint object (or issue space) and who make use of devices to act on that object, changing it.

With reference to the participants' responses, the use of technology in any form, forms part of a complete activity. All three participants pointed out that there was use of technology in their implementation of the flipped classroom. This is consistent with activity theory where tools act as the link between the students and the learning experience. The use of technology cannot be ruled out completely as it is within the framework of a comprehensive activity. The object in this regard is the flipped classroom, which the activity theory points out that it is represented by a circle; meaning that it can be changed all the time. Flipped classroom can be changed at any time, to accommodate or suit, student, lecturer and or content.

Thabo

I used black board as a platform to post all these resources and learning material, which they had to go through before class.

Mary

...that but I also ask them to prepare a certain part and I think it was reading, watching, watching videos. So, it was mainly blackboard and prescribed textbook. I would give them simple and most basic questions to do and then build on that in the next class.

Edward

They read through the textbook themselves and they can now get additional information also from the articles, other books and compare when answering the questions, and then they come to class and we have a 2-hour discussion.

It is evident that content or learning material is not just given to students, but lecturers make students aware that they need to go through the material in preparation for the next class, so that they can engage in meaningful discussion. Literature shows that there are two key components to student engagement. The first is, “the amount of time and effort students spend on academic activities and other activities that lead to the experiences and outcomes that constitute student success. The second is the ways in which institutions allocate resources and organise learning opportunities and services to induce students to participate in and benefit from such activities” (Kuh et al., 2005, p. 9). The way in which the participants ‘flip’ their classes echoes the sentiments of Kuh in the second key component to student engagement. The lecturers made means to allocate useful resources to students, at the same time organizing learning opportunities that persuaded students to participate in learning activities and benefit from them.

Conclusion

This study explored lecturers’ perspectives regarding the use of flipped classroom in one South African rural university. The study found that the lecturers perceived flipped classroom as an essential strategy for promoting student engagement. The findings have implications for the use of flipped classroom in rural context. It has highlighted the types of resources that can be harnessed and used to flip classrooms in the universities located in rural areas. The uses of various resources and platforms such as the blackboard and cell phones facilitate the flipped classroom. In the twenty-first century, characterised by knowledge society and innovation, we argue that the flipped classroom in a rural university can be used to enhance students’ learning, essential for acquiring relevant skills and knowledge. Despite challenges in rural areas, flipped classrooms can be useful when implemented properly, taking into consideration existing resources. This paper is based on a small sample of three lecturers and one university. We recommend a large scale quantitative research that will shed light on the use of flipped classrooms in South African rural universities. We further suggest that more lecturers use the flipped classroom to enhance student engagement.

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VIEWS OF PRINCIPALS ON FACTORS AFFECTING THEIR LEADERSHIP AND MANAGEMENT PRACTICES IN SCHOOLS IN QUMBU EDUCATION DISTRICT

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Abstract

This study reports on principals' views about factors affecting their leadership and management practices in Qumbu Education District schools. A qualitative design technique was adopted in this research. This research is a case study of ten randomly selected principals from secondary schools of Qumbu Education District to participate in this research. Face-to-face interviews were conducted to collect the data from the sampled principals. A thematic approach was used to analyze the data. The study indicated that lack of proper communication channels, poor human relations amongst the role-players, and teacher unions' influence affect principals' leadership and management practices. It is concluded that the in-service training of teachers and principals is vital to address the identified factors. Programs to enhance human relations and instil good behaviour are essential to ensure that principals' leadership and management practices are not affected. Recommendations are made based on the above findings.

Keywords: leadership, management policies, principals, Qumbu education district

Introduction and Background

The study reports on principals' views about factors affecting their leadership and management practices in schools in the Qumbu Education District. From personal observations and experiences, principals are the key role-players at the forefront of functional schools; as with De Villiers and Pretorius (2011), effective school leadership and management are critical in ensuring successful outcomes for all involved in education. From an economic viewpoint, Hayes (2012) documents that strong leadership and management are crucial factors in fostering innovation, unlocking the workforce's potential, and ensuring organizations have the right strategies to drive productivity and growth. He further states that research shows that countries such as the United Kingdom (UK) lost \$ 19 billion per day due to ineffective leadership and management in the workplace. The implication is that their leadership and management practices can accomplish the organizational goals set up by stakeholders such as the Department of Education (DoE), communities, parents, teachers, school governing bodies (SGBs), and any interested parties in the education of a country without interruption.

Manaseh (2016) observed that the job of principals is demanding and complex and coupled with correct decision-making in ensuring that the tasks are performed accordingly. Lingam and Lingam (2015) have the same opinion as Manaseh (2016) in viewing the principals. They view principals as agents in schools whose duties are to ensure that effective implementation and management of education reforms depend on them (Lingam & Lingam, 2015). On that note, the findings in a study conducted in the Lakki Marwat District by Hussain et al. (2016) show that effective leadership and management skills are critical in ensuring institutional success. The observation by Hussain et al. (2016) and Manaseh (2016) suggests that effective leadership and management skills are essential for schools' functionality.

Related reports on media show that dysfunctionality, coupled with poor learning and teaching culture, violence, and conflicts are prevalent in some schools that negatively affect principals' management practices. In that instance, Miller-Vaz (2015) found that violence in Jamaica was prevalent, and one of the contributing factors in the phenomenon was the nature of leadership styles adopted by principals. Around the year 2007 in Jamaica, it was reported that the incidence of violence, including stabbings, sexual abuse, and assaults were high (Miller-Vaz, 2015). It is evident that the culture of learning and teaching in the affected schools was in crisis and further led to a demoralized and stressed nation. Lingam and Lingam (2015) assert that schools with effective leadership can create a conducive and harmonious environment for everyone to attain their set goals, which implies that principals' leadership styles have a more significant impact on schools' functionality. On that note, Lingam and Lingam (2015) state that one of the keys to successful turnaround schools in the USA is how leaders model the way.

It is argued by Mestry and Schmidt (2012) that limited support to female principals by stakeholders such as teachers, learners, communities, and parents seems to affect their capabilities in managing schools' activities and implementation of policies. The comment provided by Mestry and Schmidt (2012) seems to suggest that there are still some stereotypical myths to stakeholders that it is only males who could lead and manage schools successfully. The gender stereotypes that are often pervasive and entrenched in stakeholders can have lasting effects on female principals' career possibilities (Mestry & Schmidt, 2012). Thus there is a dire need for fully decolonized stakeholders in accepting that irrespective of gender what matters is the quality of leadership one has in an institution to grow and develop. It appears that in situations such as these, the decolonization of the minds of stakeholders is essential to afford everyone who possesses the quality of leadership to manage the institutions.

Although female teachers predominate males in schools, females are in the minority in leadership positions (DoE, 2006). The South African government promulgated Acts that do not favour gender discrimination. For example, Labour Relations Act number 66 of 1995 and Employment Equity Act number 55 of 1998 prescribe that the employment of a person should not be based on gender other than the competency of the particular person. Thus, the implication is that reluctance to support the female principals is against the South African Acts of 1995 and 1998 and could affect their leadership and management practices. On that note, De Villiers and Pretorius (2011) believe that everyone tends to excel in their duties in an environment where they are recognized and valued by people around them.

Msila (2014) argues that government alone cannot manage to improve the functionality of schools. His argument was based on the effects of power relations between principals and teachers who are much inclined to unionism and drag to implement the policies to develop the institutions. He noted that in schools that exhibit such strong political teacher trade unions, management and leadership practices tend to be in crisis. Therefore, this implies that in such a working environment, the principals would struggle to execute their leadership and management practices to improve the functionality of the schools.

On that note, Sohail et al. (2017) believe that there is a need to promote workers' professionalism. If someone lacks professionalism in the work environment, that leads to undermining and violating the clients' rights to access the services they deserve. It is clear that when teachers do not comply in implementing the approved governmental goals, they are violating the rights of learners who should access teaching and learning services. Leadership

and management practices of principals are hampered as they are judged by teaching and learning quality. The quality of teaching and learning is one of the teachers' expectations. With this expectation in mind, Hill-Berry (2016) asserts that teachers are expected to operate in socially accepted ways of delivering educational services.

The leadership and management practices of principals are in a crisis where parents' limited participation in decision-making for the schools to grow and develop. Such observation is affirmed by Mncube (2009) when he states that parents are not yet playing their full role as governors mandated by legislation in some schools. In some instances, there seems to be confusion amongst the school governing bodies (SGBs) in playing responsible and accountable for their roles in school activities. The South African Schools' Act of 1996 clearly stipulates the functions of SGBs to avoid the crisis of overlapping in taking someone's roles in the school context.

Changing SGBs within a three-year term could prove challenging to principals and the DoE in inducting the newly established ones to understand their responsibilities. At the transition stage of the newly established SGBs, principals are faced with no option other than to adjust to new working relations, and coaching the incumbents by so doing increases their workloads. This observation is in line with what Brown and Conrad (2007) state. To be prosperous in their management and leadership practices, leaders should understand the people they lead and the complex nature of the environment within which they function. In light of this background, it prompted the researchers to establish principals' views on factors affecting the leadership and management practices in schools. In this regard, the main research question posed was: What factors affect principals' leadership and management practices in schools in South Africa?

Theoretical Framework

The theoretical framework that underpins this study is transformational leadership. It is chosen because it accommodates both male and female leaders by inspiring the subordinates to excel, encourage creativity, and foster human relationships (Netshitangani, 2016). Transformational leadership seems relevant, especially that it has to do with promoting human relations in a work environment. As with Mwamwenda (1989), people push for excellence when supported and motivated, either intrinsic or extrinsic. Good human relations in a conducive working environment could enable the leaders and subordinates to attain the set organizational goals as a team. In other words, good relations amongst the stakeholders indicate and confirm collaboration, which makes it possible for them to strive for developing their institution.

Methodology

This study is a qualitative study. In this research, a case study design was adopted with an interpretive phenomenological research paradigm. It is adopted because it allows the researcher to understand better the phenomenon under study (Stake, 2005). Case study design is useful for studying educational innovations, evaluating programs, and informing policies (Stake, 2005). In addition to its nature of affording the researcher with more meaning of the problem, it is suitable for a case study that involves few participants, such as in this current research (Smith et al., 2009).

The rationale for selecting principals to participate in this research was to solicit their views and experiences on factors affecting principals' leadership and management practices in schools. The sampled principals were seven males and three females. All the participants in

this research had indicated that they have more than five years of principal experience; before the researchers' actual collection of data, ethical measures such as soliciting their permission, ensuring anonymity and confidentiality were adopted. False names were used to ensure the anonymity of the participants. Face-to-face interviews with participating principals were conducted in English, and each of them was afforded 15 minutes to respond to the question which was done to ensure creditworthiness and fairness of the data collection tool to all the interviewed principals who volunteered to participate in this research.

Data analysis and results

The thematic approach was adopted to analyse the collected data, where all similar responses from the participants to the questions were grouped for interpretation and analysis purposes. The participants were asked to respond to the questions asked to enable the researcher to arrive at a reliable conclusion. They were asked to provide their views about what factors affect principals' leadership and management practices in schools. The first factor that was advanced by the majority of participants in response to the question was communication. Nine out of ten interviewed principals affirmed that communication channels hamper the leadership and management practices of managers in the workplace. For example, some replied in this way:

Jim says, *“I noticed that some teachers just report their concerns to school govern bodies and officials of DoE. They report the concerns without having been discussed at school level.”*

Sam expresses, *“lack of communication skills is a problem that spoils the running of school.”*

Moses states, *“In a majority cases, some of my staff do not respond when I send them instructions through emails.”*

“I have observed that delegating someone who is not trusted by other teachers affect the operations of the school,” responded so Don.

“In my school, learners burnt down three classes as they did not approve the reply given to them by SGB,” said Mizy.

It appears that lack of communication amongst the role-players in the school has some serious repercussions.

The second factor raised by the interviewed principals was mutual relationships amongst role-players. Their assertion suggests that there are difficulties in attaining organizational goals without a reciprocal relationship amongst role-players.

The following are the excerpts of the interviewed principals:

Mizy expresses, *“Good principal-teacher relationship is critical in ensuring that activities of school are done.”*

Macs responds in this way, *“Unnecessary conflicts tend to arise where there is no effective relations amongst the stakeholders.”*

Noxy divulged that she is not respected by some teachers, parents, and learners because she is a female teacher. She said, *“I am not favoured by my staff, parents, and learners, I do not know whether it is because I am a female.”*

The responses rendered by the participants seem to register that good human relations and strong politics amongst the role-players could influence the working conditions.

The third factor given by the interviewed principals was the affiliation of teachers to teacher unions. The following response was noted from one of the participants.

AK claims, *“Whenever I instruct my staff to carry out duties as in line with the policies of the department, they would say their union has not said so yet.”*

Nomzie expresses her feeling, *“I am not happy at all due to the way teachers, learners and parents are reluctant to comply to the regulations not unless is also approved by their unions.”*

Babs articulates in this way, *“They only advance that their unions should be aware and dictate to them what to do.”*

It is clear that where teachers are not taking the instructions from their superior other than is approved by their unions, the school's goals are likely to be affected.

Discussion

The following three findings emerged, put in themes, and discussed in the following section.

Lack of proper channels of communication

From the responses given by the participants, it appears that poor communication in the workplace, whether written or oral, can obstruct the efficiency of an organization. For example, vague email messages that require clarification, documents that need rewriting due to errors, and uninformed presentations and speeches can significantly affect its flow of work. The implication thereof is that effective business communication skills are crucial to successfully completing any project, large and small. It can be concluded that without implementing transparent communication practices to the employees; however, the organization could struggle to achieve its objectives and experience dysfunctionality. Kulsreshtha et al. (2013) affirm that the principal-teacher relationship also profoundly impacted the school environment. On that note, Wille (2013) asserts that the workplace can be a challenging environment, particularly when communication lines between employees and bosses are not running smoothly. He further lamented that it is vital for communication to begin from upper management and filter through to each employee so that people feel safe, comfortable, motivated, and clear in their goals when they are at work (Wille, 2013).

Human relations

As with Kulsreshtha et al. (2013), human relation refers to the human resource's ability and potential to achieve the school goals and develop a healthy school environment. There seems to be a general agreement from the participants that possibilities to attain the set organisational goals are limited without good human relations amongst the school stakeholders. The implication is that poor human relations amongst the school stakeholders affect the leadership and management practices. Principals are measured against the quality of teaching and learning in their schools. Failure to accomplish the set organizational goals, as with the participants' assertion, is associated with poor relations and inability to influence the subordinates to work towards the standard set of goals.

Influence of teacher unions

American education was found to be negatively affected by teacher unions (Coulson, 2010). The claim supported by Coulson (2010) shows that teacher unions sometimes have opportunities to hold back the improvement in educational quality. The participants' responses in this research show that teacher unions influence teachers' reluctance to implement the schools affiliated with them. The reticence that the teachers can carry out duties and policies when only instructed by teacher unions could affect principals' leadership and management practices. The implication is that principals are left with no latitude to run their schools in a situation where teacher union power becomes strong. Such schools could lose their social responsiveness and may no longer be centres of excellent learning and teaching. The concerted efforts to overcome the identified findings are briefly discussed in the following section.

Recommendation and conclusion

Based on the findings that emerged from the study, it is recommended that teachers' and principals' in-service training is vital to create a conducive environment in attaining the set organizational goals. Programmes to enhance human relations and instil good behaviour are essential to ensure that principals' leadership and management practices are not affected. The suggested programs should involve orientating stakeholders on how to relate to, support, and motivate one another.

It can be concluded that principals who are faced with factors such as poor communication skills, poor human relations, and strong unionism on the part of teachers, learners, and communities are not likely to succeed in making their schools function effectively in achieving the set goals. Engaging school stakeholders in programs that instil skills to work jointly in a user-friendly manner are essentials.

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TEACHERS' PERSPECTIVES ON THE USE OF SMART BOARDS IN TEACHING BUSINESS STUDIES IN THE TSHWANE WEST DISTRICT

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Abstract

This study investigated the perspective of secondary school teachers on using smart boards when teaching business studies. Technological pedagogical and content knowledge (TPACK) was used as a framework through which this study was viewed. This study used a qualitative multiple case study within an interpretive research paradigm. Five business studies teachers were purposefully sampled based on their experience of using smart boards. Semi-structured interviews and observations were data collection strategies. Thematic analysis was adopted for data analysis. Credibility was applied in the study to ensure the trustworthiness of the study results. The ethics guidelines were also taken into consideration. The research question for this study was: How do secondary school teachers use smart boards in teaching business studies in the Tshwane West district? The findings revealed a positive perspective among business studies teachers as the use of smart boards have made it easier for them to deliver lessons using different features. Again, the findings revealed that using a smart board brought real life situations into the classrooms and enhanced learners' active participation in the learning. It is recommended that teachers be provided with more training on professional development in order to reach the level of expertise where they can use a smart board innovatively and integrate smart boards in a business studies classroom.

Keywords: *Business studies, ICT, integration, secondary schools, smart board, teachers, teaching.*

Introduction and background

The development of the education system in many countries during the 21st century has forced various stakeholders to keep abreast with the continuously changing teaching and learning environments (Batdi, 2017). Education systems all over the world have been transformed because of the incorporation of educational technologies in the classrooms (Alfaki & Khamis, 2014). Globally, many schools have incorporated different information and communication technology (ICT) tools in their teaching and learning practices in both primary and secondary schools (Teck, 2013). We cannot deny that the incorporation of ICTs into classroom activities have influenced the way these activities are carried out (Alfaki & Khamis, 2014). The education system of the 21st century requires more practical teaching methods, where visually oriented devices replace traditional blackboards. The use of ICTs causes educational changes that bring new learning opportunities that these ICTs generate to achieve teaching and learning goals (Davidovitch & Yavich, 2018).

Although there is a rise in the use of ICT gadgets in education, the role of teachers in the success of achieving the classroom objectives will remain significant. The availability of ICT in education will not replace the human aspect of needing teachers (Bester & Brand, 2013). Teachers will always be needed to operate the available ICT to perform classroom activities. Seraji, Ziabari and Rokni (2017) also support that ICT cannot be regarded as a methodology; therefore, teachers are needed to integrate the existing ICT tools into relevant methodological practices to improve teaching and learning.

It is also indisputable that teachers may not be well conversant with the integration of this technology in the classroom. Teachers require technical support and professional development to boost their confidence and effectively use ICT to deliver instruction (Alfaki & Khamis, 2014). Teachers should be provided with sufficient training on technologies such as smart boards to master how to effectively integrate both the hardware and software to design lesson activities, plan their lessons, and to share information with learners and other teachers. The quality of training that teachers receive will determine how they demonstrate their technological skill during their teaching.

Using digital technologies to improve education systems has been appreciated by many education departments all over the world, including in South Africa. South Africa, one of the many countries that have adopted the use of digital technologies, has invested a great deal in providing educational tools to enhance teaching and learning. However, the gap identified by this study is that teachers have been provided with the tools but there is limited research on their perspective about using the tools. Similar studies have been conducted about using smart boards in teaching and learning, but their foci were different. Bahadur and Oogarah (2013), conducted their study on teachers' and learners' perceptions of the potential benefits and drawbacks of using a smart board. Karadag, Koc and Kalkan (2017) looked at the positive and negative impacts of using a smart board. Wafa and Khamis (2013) focussed on the attitudes of mathematics teachers toward using smart board, whereas Davidovitch and Yavich (2018) focussed their attention on its effect on the school system. Alfaki and Khamis (2014) concentrated on the difficulties of its usage in the classrooms. Based on this evidence confirming the research gap, the researchers were prompted to investigate teachers' perspective on the use of a smart board in teaching and learning the business study subject. This article emerged from the major study that focussed on the integration of smart board technology in business studies classrooms in secondary schools in Tshwane West District.

Literature review

Alfaki and Khamis (2014) define a smart board as a large whiteboard that shows information generated from a computer and projected to a screen using the built-in projector. A smart board offers a multimodal teaching and learning environment that enables teachers to access programmed images, to write on the board, and use subject related software programs to augment teaching and learning (De Vita, Verschaffel & Elen, 2017).

According to Jelyani, Janfaza and Soori (2014), the effectiveness of smart boards primarily depends on the way it is integrated into the classroom. Maher, Phelps, Urane and Lee (2012) confirm this view and emphasise that teachers need to carefully select a smart board's integrated features that will positively enhance the achievement of the learning outcomes. For Isman, Abanmy, Hussein and Al Saadany (2012) teachers are optimistic about using a smart board for teaching and learning, but most cannot use it effectively as a result of their limited knowledge of its features. Backadam and Asiri (2012) share the same sentiment as they attest that teachers do not effectively use the full features of the smart board but use it mainly to write and display information. This skill is stressed within the technological knowledge component (TK) of the TPACK framework.

Backadam and Asiri (2012) believe that integrating a smartboard in content delivery enables learners' participation. Learners' participation forces teachers to use a learner-centred approach to teaching and learning. Backadam and Asiri (2012) further argue that integrating a smart board in classroom activities develops a suitable way to convey the content to learners which in turn encourages collaboration among them. Shams and Ketabi (2015) have a

different perspective. They contend that the traditional method of teaching persists because teachers continue to write on a smartboard like as they would with a traditional blackboard instead of using interactive lesson strategies to construct meaning. This technological pedagogical knowledge component of the TPACK framework maintains that technology use is a gateway to improve teachers' pedagogical practices.

According to Nichols (2015), the integration of a smart board in teaching and learning encourages learners to actively participate in classroom activities and, most important, become more attentive, which leads to improvement in their performance. Mihai (2017) concurs by indicating that learners become motivated to participate in learning activities if they are provided with multiple opportunities to explore smart board functionalities. However, teachers tend to focus mostly on smart board features (technological knowledge), rather than also on its pedagogical engagement potential (Isman et al., 2012).

Using a smart board to record lessons ensures teachers that the lesson is safely storage and they can access them whenever they wish (Jwaifell & Gasaymeh, 2013) This recording technique is not the same as using a memory stick in a computer, which may be damaged or lost. With a smart board, safe lesson storage is guaranteed, and content can be retrieved as and when it is needed for sharing with learners.

It will require great effort for teachers to embrace a new way of learning and learn to manipulate the content using smart board technologies because some still only use basic application programs like Word processor and PowerPoint presentations, even when there are smart boards in the classrooms (Maher et al., 2012).

Theoretical framework (TPACK)

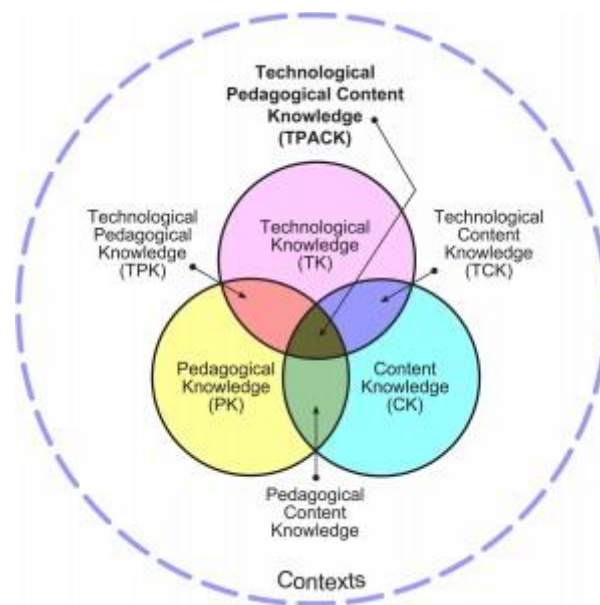


Figure 1 shows the components of the TPACK framework and how they are interrelated. (adopted from <http://tpack.org>).

The technological pedagogical and content knowledge (TPACK) theoretical framework (Mishra & Koehler, 2006) was used to guide the understanding of secondary school teachers' perspective on using smart boards when teaching business studies. Technological

pedagogical and content knowledge is the type of knowledge that teachers need to successfully teach their specified subject matter through the integration of different technologies (Harris & Hofer, 2011). TPACK encompasses three knowledge bodies, namely, technological knowledge, technological pedagogical knowledge, and technological content knowledge (Mishra & Koehler, 2006).

The three bodies of knowledge interact and form a unique knowledge required by teachers to deliver content effectively. Technological knowledge according to Koehler and Mishra (2006) is knowledge about variety of digital technologies and how to model them in teaching and learning. Technological pedagogical knowledge is how the use of technology can influence a teaching method (Koehler & Mishra, 2006) and make learning fruitful. The technological content knowledge is how the use of technology transforms the delivering of content (Benton-Borghi, 2013). In this study, business studies teachers were expected to model their ICT expertise by navigating smart board features and using programmed software to transform the presentation of content. The TPACK theory is relevant to this study because it can help teachers use overlapping knowledge components to create the best learning environment for learning.

Research methodology

Research design and approach

This study was positioned in an interpretive paradigm, which, according to Rahi (2017), is used to help researchers intensely understand the participants' natural environment. It does so by helping the researcher collect individual interpretation of participants' practices and understanding of a phenomenon under study (Rahi, 2017). This study followed a qualitative, multiple-case research design.

Population and sampling

The target population was business studies teachers from secondary schools in the Tshwane West district in Gauteng province, South Africa. A purposive sampling was used to select five business studies teachers from the four selected secondary schools (with one school providing two participants). One participant was sampled from each of the four schools, based on their teaching experience using a smart board. A fifth participant was then sampled from the school that had more than three business studies teachers. The sampling consisted of three male teachers and two female teachers all aged between 25–55 years. All participants had used a smart board in their classrooms for between 2–5 years.

The four selected secondary schools in Tshwane West district were multiple cases that had immediate access to the services of smart boards for teaching business studies. The proximity of the schools was considered so that selected schools were accessible in terms of distance.

Data collection instrumentation

Observations

Observations were conducted, and each participant was observed while they delivered a business studies lesson using a smart board. Urquhart (2015) define observation as the recording of activities by someone who neither participates in the activities nor interacts with the observed person. The technological pedagogical and content knowledge (TPACK) framework was used to guide the development of a checklist, which was used to gather data. The observations were scheduled for an hour, which was the length of time of a double period for a Business studies lesson. The observations took place during the scheduled

Business studies periods according to the schools' timetables to ensure that the research did not disturb the normal operation of the schools.

Semi-structured Interviews

The semi-structured interviews were conducted with each participant. During the interviews, the interviewees could share on their experience of their own lived environments (Cohen, Manion & Morrison, 2011). The open-ended questions were used to gather semi-structured interview data. The semi-structured interviews were planned for about 15–30 minutes with only one interview per participant. During interviews, the researcher asked permission to audio-record participants' responses to ensure that all answers were accurately captured.

Ethical consideration

Before the commencement of the data collection process, permission to interact with the participants was requested from the Gauteng department of Education (GDE) and the principals of the selected schools. An ethical clearance from the Ethics Committee of the University of South Africa College of Education was also applied for and received. The purpose, procedures, and ethical issues of the study were all explained to the prospective participants. Their role to participate in the study was explained and they were also informed that their participation was of their own will and not compulsory. The explanation about their roles in the study enabled teachers to make an informed decision about participation in the study. Upon agreement the informed consent was complete. Participants were also made aware that they could cease their participation at any time without having to provide any explanation even after they had signed the consent forms. The participants were assured that their shared data would be kept anonymous and confidential and never be published in such a way that they could be identified. To guarantee anonymity, the participants were addressed as Participant A, B, C, D, and E.

Trustworthiness in the study

According to Anney (2014), seeking guidance from researchers is indispensable. To maintain trustworthiness, the current study used credibility as suggested by Lincoln and Guba (1985). Two pillars of credibility were applied, namely, member checking and peer debriefing. In this study, peer debriefing was maintained by sharing the findings of the study with teachers at conferences. In terms of member checks, the semi-structured interviews were referred back to the participants to ensure the correct interpretation of data and transcribed information.

Data analysis and interpretation

A thematic qualitative data analysis was used to analyse the collected data. The researcher followed the data analysis steps outlined by Mabuza, Govender, Ogunbanjo and Mash (2014), which include familiarisation, thematic indexing, chanting, interpretation, and confirmation. The audio-records from the semi-structured interviews were reviewed continuously for familiarisation purpose before they were transcribed. The coding instrument was developed and both the notes from observations and the transcripts from the semi-structured interviews were coded. Only the excerpts of participants' responses that were relevant to a particular question were captured in the coding instrument. The similarities between different codes were considered to identify patterns emerging from the coding instrument (Mabuza et al., 2014). From the emerging patterns on the coding instrument emerged the themes that the researcher used to explain the findings. The researcher included the opinions of different authors who conducted similar studies during the presentation of results and the discussion of the results that were done concurrently. The analysis was based

on the participant's perspective on the use of smart board and whether their delivery of lessons illustrated TPACK framework.

Research results

The participants were asked the following question to determine business studies teachers' perspective on using a smart board in teaching and learning: How do secondary school teachers use smart boards in teaching business studies in the Tshwane West district?

The findings and discussion are presented concurrently below. Two main themes emerged from the semi-structured interviews. These themes were (a) teacher positive perspectives and (b) attitude towards integrating a smart board in the classroom environment.

Teacher positive perspectives

The participants were asked about their views on the integration of a smart board in a Business studies classroom. The findings revealed that all five participants solidly agreed that using a smart board helps them advance an improved level of teaching. Participant B outlined: *'It is great because it makes our lives much easier, we are able to interact with children'*.

Another participant (A) shared:

'I think it is helping a lot because now a learner is able to, for example, when I give a difference between formal and informal sectors, I'm able to show my learners videos using a smart board for them to understand'.

The above verbatim expressions show positive perspectives in that the participants have as a greater chance of success when teaching with a smart board. Gashan and Alshumaimeri (2015) revealed that improving teacher perspectives on smart board use is an important mechanism that can improve the standard of teaching and learning in the classroom.

The findings again showed that all the participants believed that a smart board could contribute positively to the process of teaching. They further indicated that a smart board gives them the opportunity to use numerous computer visuals to make teaching easy, enjoyable, and remarkable.

Another participant (C) said:

'I feel like it is going to make teaching and learning very simple because learners will be seeing what the teacher is talking about, for example, if the teacher is explaining about Business studies he will be able to show different types of businesses'.

Smart boards allow teachers to use numerous embedded teaching and learning features. Yoke and Ngang (2017) agree as they attest that in using a smart board, learners get an understanding of the way businesses operate in the real world, which empowers them with strong work ethics.

The findings further highlighted that most of the participants felt that a smart board helps to draw learners' attention when the content material is displayed on the screen. One participant (B) mentioned: *'A smart board makes the classroom activities fruitful because learners are eager to participate and enjoy the lesson as it is colourful for them'*.

Another participant (A) claimed: *'It is very easy to catch attention from my learners since they are familiar with the smart board features. It is easy for them to understand my lesson since it is not a boring lesson'*.

These results concur with the study by Nichols (2015) who argue that learners are interested in the features of a smart board, which leads to their increased concentration during a lesson. Nhete, Sithole and Solomon (2016) share similar sentiments as their study reveal that Business Education teachers believe that they could use smart boards to increase learner attention to the lesson, encourage learner participation, and develop lessons that are both task-oriented and learner-centred.

Teachers' Attitude

Although all five participants agreed that a smart board could be utilised efficiently to raise the standard of teaching and learning outcomes, some believed that incorporating a smart board in the classroom is determined by the subject in question. Participant E mentioned: *'Business studies is not like Maths; Maths have graphs and so on. In Business studies, I feel that we are still lacking so many things of the smart boards'*.

The above results are supported by the results of the study conducted by Lindberg, Olofsson and Fransson (2017), who claim that integrating technology in education is dependent on the nature of the subject matter being taught. Under the same notion, Pamuk, Cakir, Ergun, Yilmaz and Ayas (2013) argue that smart boards are often incorporated in classrooms by teachers teaching subjects such as geography, geometry, biology, and English language.

The results also indicated that some participants claimed that there is a link between teacher attitude on smart board use and the age of teachers. They mentioned that young teachers are more likely to use a smart board during teaching. Participant A commented: *'As a young teacher, it is very easy for me to teach my lessons using a smart board and implement a paperless classroom'*.

In their study, Seraji et al. (2017) exposed that there is a relationship between teachers' attitude towards ICT incorporation in the classroom and teachers' age. They revealed that young teachers demonstrated positive attitude and were more willing to teach using technology than older teachers.

Observation

The current study's participants, who were business studies teachers in secondary schools, integrated smart boards during the observed business studies lessons. All five participants demonstrated technological knowledge as they used smart board in teaching business studies. The participants (all of them) evidenced their technological knowledge (Mishra & Koehler, 2006) as they confidently switched on the smart board and displayed the prepared topics that they wanted to teach. They also demonstrated their ability to navigate the topic sites using smart board features. Participants demonstrated technological content knowledge (Mishra & Koehler, 2006) because they used smart boards to influence the understanding of content. The use of different features ignited learners' interest and they were encouraged to participate in the lesson. In other words, technological pedagogical knowledge (Koehler et al., 2013) was proposed because the participants' delivery of lessons was changed as the result of using smart board. This is in accordance with the results of Bahadur and Oogarah (2013) who express that most teachers have confidence that a smart board is a suitable technological

gadget for teaching diverse learners while growing the level of learner involvement in the classroom.

It is evident from these results that business studies teachers' perspective on smart board use depends on their knowledge of how to integrate a smart board, how it improves their delivery of lessons, and the manipulation of content using its different features. It can be argued that this study again proves that using a smart board encourages learners' active participation in their learning and portrays a more realistic life situation, which enables learners to venture into reality.

Conclusion

This current study investigated teachers' perspective of using a smart board and the findings revealed that smart board can make teaching and learning easier and can improve the delivery of lessons. The participants no longer tried to attract learners' attention as the use of smart board encouraged cooperative learning and a real-life situation learning. The type of subject and teacher age range was also revealed as potential barriers to the use of a smart board. The use of TPACK framework has shown how the participants displayed overlapping knowledge components and tried to create the best learning environment for their learners. It is recommended that teachers be provided with more training and professional development in order to reach the level of expertise where they can use a smart board innovatively and integrate smart boards in a Business studies classroom.

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SIMULATION-BASED LEARNING STRATEGY TO ENHANCE THE LEARNER-CENTRED APPROACH IN ACCOUNTING DURING WORK-INTEGRATED LEARNING

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Abstract

This paper examined the use of simulation-based learning to prepare accounting student-teachers on how to teach through the learner-centred approach during work-integrated learning (WIL). Accounting student-teachers are trained not only to transfer subject content knowledge and skills while studying to become accounting teachers. Instead, they are taught to assist learners in discovering new knowledge, skills and changed attitudes towards the subject. However, during WIL, accounting student-teachers are assigned to mentors that have an inadequate grounding in the learner-centred approach, thus leading the student-teachers to resort to the use of the traditional teacher-centred approach. Findings were reported on five accounting student-teachers placed in three schools for WIL, three experienced accounting teachers and an accounting subject advisor through Participatory Action Research (PAR). Classroom observations and Free Attitude Interviews (FAI) were used to generate data from the experience of student-teachers, and data were analysed and interpreted using Critical Discourse Analysis (CDA). The findings reveal that simulation-based learning leads to effective learning as it provides a platform to practise the integration of a learner-centred approach in teaching accounting during WIL. Accounting student-teachers need continuous support in the integration of the learner-centred approach to cushion them from the adverse effects of falling behind in the contexts that require high skills.

Keywords: *Simulation-based learning; Work-integrated learning; Learner-centred approach*

Introduction

The Department of Higher Education and Training (DHET) 2015 policy on the Minimum Requirements for Teacher Education Qualifications (MRTEQ) emphasises students learning in and from practice to enable them to gain the necessary knowledge and skills in teaching. Students learn from practice through using discursive resources to analyse different practices across a variety of contexts, drawing from case studies, video records and lesson observations to theorise practice and form a basis for learning in practice. Learning in practice involves teaching in an authentic and simulated classroom environment whereby students use relevant theories and approaches learned at the university. MRTEQ pays close attention to the various knowledge that underpins teachers' practice, such as personal development, communicative skills and reinforcing the students' ability to apply theory into the 'real world' (Petker & Petersen, 2014). In this manner, students can build on their confidence and pedagogical content knowledge as learning serves the importance of inter-connections between numerous practices and knowledge in a variety of contexts. MRTEQ, as a result, emphasises work-integrated learning (WIL) taking place in the workplace and including aspects of learning from practice, such as observing and reflecting on lessons taught by others as well as preparing, teaching and reflecting on lessons presented by oneself.

WIL is defined as a purposeful, organised, supervised and assessed educational activity that is required for the completion of a Bachelor of Education (B.Ed) or Postgraduate Certificate in Education (PGCE) qualification that integrates theoretical learning with its applications in

the workplace (University of the Sunshine Coast, 2015). It plays a significant role in accounting student-teachers as it affords them the experience in an actual teaching and learning environment whereby rigorous professional negotiation that leads to the development of pedagogical skills and enhanced teacher quality takes place. The focus of WIL is for accounting student-teachers to apply theories and approaches about teaching into practice within an actual classroom environment (Foncha, Abongdia & Adu, 2017). This means helping accounting learners to discover new knowledge, skills and changed attitudes through a continued active classroom engagement. Thus, through WIL, accounting student-teachers realise the value of practise as they perceive it to be the root of their preparation for the teaching profession (Kiggundu & Nayimuli, 2009). It is for this reason that accounting student-teachers are assigned to mentors to practise their teaching within a proper school setting whereby there is supervision to prepare them for teaching (Ozdaz, 2018).

During WIL, accounting student-teachers encounter matters concerning classroom management, effective use of teaching methods, learner participation and the organisation of teaching activities. This practice enables them to acquire first-hand teaching skills in accounting and realise the areas in which they may need to improve on. However, the major challenge for accounting student-teachers during WIL is that they are assigned to mentors that have an inadequate grounding in the learner-centred approach (Du Plessis, 2013). The problem is that accounting mentors are not aware of the relevant strategies and theories underpinning the South African Curriculum and Assessment Policy Statement (CAPS) in accounting (Khoza, 2015). As a result of not having a clear understanding of the approaches and theories shaping the curriculum, accounting mentors resort to using the traditional methods which they have been using throughout their years of teaching. This means that during WIL, accounting student-teachers adapt teaching approaches and theories that are inconsistent with the CAPS and the theory learned in the university.

Martins, Caires and Almeida (2010) conducted research to identify and assess student-teachers' feelings and perceptions regarding WIL, as well as the impact of the experience of WIL on their personal and professional development. This paper extends the study to improve the teaching of accounting during WIL further to prepare student-teachers on using the learner-centred teaching approach. The paper focuses on the WIL of student-teachers in a school to practise the teaching of accounting as learned from the university. WIL is taken as an essential component for the development of student teachers to gain the necessary knowledge and skills in teaching accounting to learners. It is a process whereby student-teachers practise the delivery of content to learners in actual teaching. It is meant to provide for the authentic context in which student teachers are exposed to experience in the schools (DHET, 2000). The programme is one of the means to equip student-teachers and to prepare them to serve learners when employed in schools. In all these expectations and training to become a professional teacher, the environment in which learning occurs, the culture, and the economy of the schools need to be considered. As a response to the above-mentioned challenges, this paper explores the use of simulation-based learning as a strategy to enhance the learner-centred approach in accounting during WIL.

Simulation-based learning

In this paper, simulation-based learning is developed and used to train accounting student-teachers in preparation for WIL. Simulation-based learning permits student-teachers to be able to engage a learner-centred environment that promotes problem-solving, co-operative learning, self-efficacy and application (Sottile & Brozik, 2004). Ideally, it provides accounting student-teachers with a hands-on exercise that reinforces and illustrates theories

that are consistent with CAPS. Thus, a vital objective of simulation-based learning is to ensure that accounting student-teachers are exposed not only to the theory taught in the university but also to real-life situations. Simulation-based learning assists accounting student-teachers to meet the objective as they replicate real-life situations (Gerace, 2020). It further encourages student-teachers to engage in critical reflection about teaching accounting in a learner-centred environment which can have a transformative effect. Therefore, simulation-based learning leads to effective learning as it provides a platform for accounting student-teachers to have a repetitive practice, ability to engage a learner-centred environment and be given immediate feedback (Toy *et. al.*, 2017). As confirmed by research, the use of simulation-based learning displays improvements in the students' knowledge, skills, attitude and performance.

Research question

Essentially, this paper is guided by the following question:

- How can the simulation-based learning strategy be used to enhance the learner-centred approach in accounting during work-integrated learning?

Theoretical framework

This paper is guided by Critical Emancipatory Research (CER) as a paradigm to enable positive interaction and invitational environments between the accounting student-teachers and their mentors during WIL (Nkoane, 2012). CER created a platform for the accounting student-teachers, their mentors during WIL, the accounting lecturer and teaching practice lecturer to work together equally to learn from one other. Lecturers got to understand how teachers, as mentors, teach the subject and discuss the implications of the methods used with the teachers. On the other side, the student teachers got the platform through CER to be part of the discussions rather than being receivers and not only implementers of the methods taught. The discussion of expected threats from numerous outlooks was accommodated, and our role as researchers was to form space and conditions beneficial for enablement, to nurture courage and to re-establish common fairness concerning all participants (Roberts, 1991). Due to its multifaceted outlook, CER encourages the influence of discourse, whereby an exchange of ideas is encouraged by assurance to the common task of learning (McPhail, 2004). For this paper, we worked together with accounting student-teachers and their mentors to address issues relating to using the learner-centred approach in the classroom, thus seeking ways to improve the current situation.

Through CER in the study, participants were empowered by simulation-based learning; student-teachers assumed the role of being facilitators and allowed learners to participate actively in their learning; they were liberated from being less useful to meeting the needs of a real-life situation (Mahlomaholo 2009). Biesta (2010) emphasises emancipation as having a central role in modern educational theories and practices. He states that people can be emancipated, become independent and free, as a result of an intervention. Participants in the study worked together to address issues affecting the teaching of accounting and decided on the best approaches to improve the situation. The students were engaged in the study because every teacher wants learners to become independent and autonomous, to think for themselves, make their judgments and draw their conclusions.

According to Carrington and Selva (2010), CER is transformative. It is founded upon anti-oppressive philosophy and is a lens through which one can identify and change the root sources of oppression (Moleko 2014). This study used CER to transform the teaching of accounting, to address the needs of CAPS, and to transform the marginalised experience of

mentor teachers and students to contribute to improving the teaching programme. Moleko (2014) further notes that the practice of more rigorous research that overtly intends to be liberating calls for a critical gaze that views current practice into a broader perspective, building theory in action and acting on theory. Through CER, the modes of enquiry were fostered to convert theory into actions that address the problems (Nkoane, 2012). During WIL in this study, participants were emancipated by gaining an understanding of the power relations that constitute their situation, which requires demystification and to change the status quo, overcome injustice and alienation and promote the participation of the people (Biesta, 2010). CER, in the study, empowered them through the strategic action of WIL from the dictates of compulsion, tradition, precedent, habit, coercion and deception.

Research methodology

To fulfil the aim of this paper, Participatory Action Research (PAR) was used as an approach. The purpose of PAR is in the enablement of oppressed persons to work together for social transformation which inspires the capacity for growth and the capacity structure of all who take part (McTaggart, 1997). According to Hlalele and Tsotetsi (2015), PAR addresses issues of social justice that seek to include and empower minorities and communities that are often marginalised. PAR, in this study, therefore, allowed putting CER into practise by ensuring that everyone who has contributed to the outcome of the research has a voice when it comes to making decisions. Five accounting student-teachers, two mentor teachers, an accounting subject advisor, accounting lecturer and the teaching practice lecturer formed the team of participants in this study. Meetings were held following the PAR cycle of Kemmis and McTaggart (2007): preparation, implementation, planning and reflection until the outcomes were achieved. Furthermore, classroom observation tools that comprised the following components were used: planning and approach, the sequence of the lesson, teaching skills, class management and appearance. Ideally, PAR promotes equity and advocates social justice, peace, freedom and hope (Mahlomaholo, 2009). Hence, accounting teachers, students and lecturers got opportunities to respond to the use of simulation-based learning in WIL.

In ensuring trustworthiness, the data that was generated from the meetings and classroom observations were recorded using a dictaphone. The recordings were transcribed verbatim before the analysis of the data began, and participants were consulted to confirm word-for-word accuracy and representation. To ensure credibility, both primary and secondary sources of data were thoroughly consulted and reviewed and were used to validate the data collected through the meetings and classroom observation tools. Purposive sampling was used in this paper to select particular characteristics and elements from the population that would be a representation of the target group (McMillan & Schumacher, 1997). Ideally, purposive sampling permitted us to increase the use of the information that was obtained from the sample. Thus, we selected five accounting student-teachers, two mentor teachers, an accounting subject advisor, accounting lecturer and the teaching practice lecturer, as they comprised a specific group. We did not attempt to make generalisations, nor did this group represent the population at large.

Preparation phase

The challenge of accounting student teachers using approaches and theories that were inconsistent with the CAPS document was identified during their assessment for WIL. Upon engaging with student-teachers to determine the causes of using inconsistent approaches and theories, it was discovered that on their arrival, student-teachers were assigned to mentors who either deserted them for the better part of WIL or could not mentor them. This meant that the student-teachers had to either go to the classroom unaccompanied by their mentors or

adopt unreliable approaches and theories that were not meaningful in teaching accounting. This challenge brought serious concern to the accounting lecturer and the teaching practice co-ordinator, as student-teachers received inadequate support from their mentors in integrating and applying the theory learned from the university.

In the first phase which was the preparation phase, an informal meeting with the accounting student-teachers together with their mentors was conducted to hear their general views on the approaches and theories used to teach accounting. Among other things, the discussions included problems encountered in applying the learner-centred approach using constructivism theory and proper capacity building in mentoring student-teachers. The issues that were raised included not having an adequate grounding in applying the approaches and theories underpinning CAPS and inadequate training in mentoring the student-teachers. A common challenge raised by both parties involved a lack of skills and knowledge concerning the learner-centred approach and constructivism theory. Mentor teachers further voiced their concerns about the inadequate training that was received when CAPS was implemented as a national curriculum. Due to their inability to having a clear understanding of the approach and theory shaping the curriculum, they resorted to using traditional methods of teaching which they have been using throughout their teaching years.

There were suggestions that a hands-on experience for accounting student-teachers needs to be created to give them a real-life experience before they can engage in WIL. Mentor teachers encouraged the idea and further suggested that relevant stakeholders should be invited in this process to allow constructive criticism and immediate feedback to the student-teachers. PAR, as a research methodology, seeks to contribute to knowledge construction and bring about social transformation (Nelson, 2013). Therefore, for the preparation phase, this study permitted a democratic process to take place through inviting and including all relevant stakeholders affected by the challenge of the opportunity to construct knowledge.

Planning phase

PAR encourages good relationships between the researchers and participants to be established on principles of trust and respect (MacDonald, 2012). Therefore, a harmonious relationship between the researchers and participants was established based upon respect, humility and peace. This was done to permit participants to voice their opinions, create and build new knowledge. At this phase, a team comprising five accounting student-teachers, three experienced mentor teachers, an accounting lecturer, a teaching practice co-ordinator and an accounting subject advisor was established. The dominant idea of this phase was to plan a way forward in attempting to solve the identified challenge. During deliberations, the team suggested the development of a strategy that would give accounting student-teachers a real-life experience to train and improve their application of the learner-centred approach through the theory of constructivism.

Simulation-based learning was proposed and adopted by the team in an attempt to train accounting student-teachers to prepare for WIL. The strategy was adopted on the basis that it granted student-teachers the ability to engage a learner-centred environment that can promote problem-solving, co-operative learning, self-efficacy and application (Sottile & Brozik, 2004). An action plan was then drawn up whereby issues of priority would be dealt with systematically. To attain meaningful results, participants must have a sense of involvement while the programme is moving towards its goals (Sekwena, 2014). The co-ordinated team collectively engaged in activities by providing the tools and methods to carry out the plan. Therefore, after thorough planning, the team put in place all that was planned into practice.

Implementation Phase

During the phase of implementation, there are matters of significance that guarantee the creative process of problem-solving towards enhancing the quality and quantity of PAR (Qhosola, 2016). These matters include time factor, clarification of the decision process, and identifying and valuing expertise. Time is a precious commodity; thus, an established team through collaborative efforts most certainly requires time to meet and work towards achieving its set goals. With PAR, the co-ordinated team managed to arrange the logistics of communication to reflect and give constructive feedback in the implementation of simulation-based learning. Classroom observation tools were developed by the team to enable the evaluation of accounting student-teachers in terms of their ability to adopt and adapt the knowledge and skills learned using the simulation-based learning strategy within a classroom environment. Concerning clarifying the decision process, the team established clear expectations on how the participants will collaboratively work together in making decisions. This was an essential matter to address as it allowed thorough implementation of the action plan and avoided misunderstandings. Its aim and objectives guided the study, thus through established mutual relationships; the participants could make crucial decisions at different stages of the study.

Turnbull, Friesen and Ramirez (1998) suggests that it takes a great effort and focused attention to appreciate the expertise of participants. Thus, indigenous knowledge and local knowledge shared by the participants were central to the creation of new knowledge. This proved to be beneficial for the established team as we learned to value the insights and knowledge of others. Addressing the three issues mentioned above, the gap was bridged, and the implementation process was divided into three stages (Qhosola, 2016). The stages are the initial implementation, full implementation and programme sustainability. The initial implementation stage is where the team sought to mitigate the fear of the unknown and resistance. Issues of power were addressed with an attempt to promote democracy, peace and hope among the participants. Realistic goals and expectations were set regarding the use of simulation-based learning, appropriate timelines of generation and using data.

The full implementation stage is where the strategy was now running, and participants started noticing improvements in the application of the learner-centred approach and theory of constructivism. The activities were evaluated to assess the validity and reliability of the strategy concerning its intentions. Lastly, the programme sustainability stage was set to maintain the success of the strategy using the learner-centred approach during WIL for accounting student teachers. Sustainability of the strategy was maintained through overcoming challenges and administrating continuous critical reflection in order to implement necessary changes.

Reflection Phase

The reflection stage within the PAR cycle is crucial as it is used to evaluate the necessity to continue or start the set project (Dlamini, 2017). Both negative and positive results are considered important by the co-ordinated team. Negative results display areas of failure and indicate possible improvements required for the project, whereas positive results display success and confirm possible future improvements for the project. The cycle of PAR is thus important as discussions by the co-ordinated team entail the use of simulation-based learning strategy to be practised to give a hands-on experience of the learner-centred approach for accounting student-teachers to apply and practise during WIL.

Data collection and analysis

The principles of FAI were used to generate data because of elements of respect for people, and the research objectives were used only to initiate a conversation (Tshelane, 2013). In FAI, people talk as in a normal conversation (Buskens, 2011), unlike in cases where people respond to questions that have already been posted. The conversations among participants were free, which opened a platform to everybody to participate in the discussions. The FAI was then followed by a reflective summary, thus persuading contributors and inspiring participants to reason prudently about their arguments (Mahlomaholo, 2009). The issues of consistency and legitimacy were not emphasised during conversations, as Buskens (2011) confirms them happening in positivist and phenomenologist paradigms.

The advantage of FAI was that participants were saying more than they would have said in response to closed questionnaires. The FAI allowed us to engage in reflexivity to regulate the effects of the researchers' preconception and its impact on the research process. The research question on how to use simulation-based learning to enhance the learner-centred approach in accounting during work-integrated learning was seen as interesting, as everybody was free to intervene during a conversation. Buskens (2011) indicates that FAI may be conducted between two people or as a group, and these people are free to intervene and responses can be given flexibly. We used it as a person-to-person method of obtaining information from co-researchers.

Critical discourse analysis (CDA) was used together with CER, as they are both attentive towards emancipating praxis for transformation within the community, social fairness and democratisation (Gaffikin, 2006). Data were analysed using CDA to get an in-depth understanding of the teaching of accounting in an authentic setting from the perspective of the participants (Van Dijk, 2006). CDA primarily aims to make transparent the connections between social structures and discourse practices by thoroughly analysing the patterns of access to the discourse for different social groups.

Findings

It was evident from the meetings that accounting mentors were interested in the way student-teachers were teaching using a learner-centred approach. One teacher uttered a statement pointing to a student-teacher:

"...I liked the way you moved to assist that group of learners that had difficulty in the cash flow statement. How did you notice that they were struggling?"

Through using simulation-based learning, accounting student-teachers were allowed to practise and implement the learner-centred approach in a classroom, whereby learners could actively participate in the construction of knowledge (Kaufman & Ireland, 2016). Ideally, the strategy allowed student-teachers to create a learner-centred environment and equip their mentor teachers with the skills needed in the implementation of the learner-centred approach as required by the CAPS (Department of Basic Education [DBE], 2011). Hence, using simulation-based learning to prepare accounting student-teachers for WIL embraces the philosophies set by DBE and permits the mentor teachers to learn effective methods of implementing active learning methods.

The subject advisor also emphasised that teachers struggle to implement a learner-centred approach in the teaching of accounting.

"... a lot of our experienced teachers struggle to engage learners in their teaching, this may be due to a lack of proper training and as a result, they have developed a negative attitude towards the approach."

The subject advisor continued to appraise the way student-teachers are prepared for the teaching of the subject by saying:

"... one can see that simulation-based learning as a strategy provides our accounting student teachers with practical experience before they go for their teaching practice ... this strategy needs to be applied to other disciplines to allow the student to assist their mentors in implementing the learner-centred approach, thus contributing to their capacity building ..."

Teachers require continuous and appropriate training to implement the policies that are embraced by CAPS. Unfortunately, with no training and development, teachers resort to the teacher-centred methods as they are most comfortable to use in order to complete the accounting syllabus (Manqele, 2012). Simulation-based learning provides accounting student-teachers with a hands-on experience that reinforces and illustrates theories consistent with CAPS (Toy *et al.*, 2017). Thus, the use of simulation-based learning availed the accounting student-teachers the opportunity to teach and train their mentor teachers and gain the knowledge and skills to use in the learner-centred approach.

PAR, as a methodology, created a harmonious platform where the accounting student-teachers could voice their opinion in the study without fear of being oppressed or marginalised as students. This was evident when they mentioned that they saw experienced teachers presenting accounting, by telling students and learners being listeners in the classroom.

Student-teacher A: ... simulation-based learning has allowed us the opportunity to put the theory we learn in class into practice. As soon as we go for our WIL, we know exactly what is expected of us... Unfortunately, we had to observe mentors who were doing everything for learners and were afraid to show the teachers the other method.

Student-teacher B: I am happy that we are given the opportunity to practise what we learnt and also wish this sort of practice implemented during the beginning of our teaching studies...

Drawing from the responses of the students, it is clear that simulation-based learning creates a safe and effective learning environment for accounting student-teachers. Furthermore, students are thoroughly prepared and assessed using the strategy before going for their WIL, thus it enables an opportunity to build confidence and provide constructive feedback (Weller *et al.*, 2012).

The teaching practice co-ordinator commented as follows:

Teaching Practice co-ordinator: Experience is the best teacher, the traditional way of teaching as used by mentors is still working; however, methods and approaches that are embraced by the national curriculum need to be implemented as far as possible.

Implementing the learner-centred approach relies on the skills and expertise of teachers to plan and facilitate an active lesson (Motsoeneng, 2020). Thus, accounting student teachers must be equipped with a thorough grounding in pedagogy and content knowledge in order to transform the classroom environment into an exciting and rich setting for learners.

Conclusion and recommendations

The paper revealed that accounting student-teachers are assigned to mentors that have an inadequate grounding in the learner-centred approach during WIL. They are assigned to accounting mentors that are not aware of the relevant approaches and theories underpinning the South African Curriculum and Assessment Policy Statement (CAPS) in accounting. Accounting mentors resort to using the traditional methods which they have been using throughout their years of teaching, and during WIL, accounting student-teachers adopt these teaching approaches and theories that are inconsistent with the CAPS, and the theory learned in the university. It was discovered in the study that simulation-based learning permits student-teachers to engage a learner-centred environment that promotes problem-solving, co-operative learning, self-efficacy and application. Accounting student-teachers are provided with a hands-on exercise that reinforces and illustrates theories that are consistent in CAPS. The use of simulation-based learning stimulates, through everyday teaching and learning, the learners' acquisition of the necessary knowledge, skills and attitude in accounting, which will increase their academic performance in the subject. The paper recommends accounting student-teachers and mentors to use a learner-centred approach, which is consistent with CAPS. The educators' dependency on traditional methods and teacher-centred approaches will diminish, as space would be created for the utilisation of a learner-centred approach with the guarantee of effective and enhanced performance in accounting.

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EDUCATIONAL CAPACITY BUILDING OPPORTUNITIES, NATIONAL RECONSTRUCTION AND RECONCILIATION PROCESSES IN NIGERIA

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Abstract

This paper examined the educational capacity building opportunities, national reconstruction and reconciliation processes in Nigeria. The study adopted a descriptive survey research design. The population of the study was 2987, 2018 Batch B National Youth Service Corps (NYSC) members in Abuja Metropolis, Nigeria. The sample size of 299 was selected from the population through simple random sampling method. 299 copies of the questionnaire titled: "Educational Capacity Building Opportunities, National Reconstruction and Reconciliation Processes in Nigeria," were used to gather information from the participants. Frequency cores, mean and Pearson Product-Moment Correlation statistics were used for data analysis. Findings revealed that capacity building opportunities available in Nigeria include vocational and technical education, basic literacy and continuing education programs, Information and Communication Technology (ICT) training, skill acquisition and trade training, nomadic education and Alma Jiri schools. Thus, a relationship exists between educational capacity building opportunities, national reconstruction and reconciliation process. Based on the findings, it was recommendation that, the Nigerian government should ensure that the opportunities in capacity building such as vocational and technical education, basic literacy and continuing education programs, ICT training, skill acquisition and trade training, nomadic education and 'Almajiri' schools are extended to every zone in Nigeria so that people who never had opportunity to go to school initially could avail themselves the opportunity to improve on their economic well-being so as not to be idle.

Keywords: *Capacity building opportunities, national reconstruction, national reconciliation.*

Introduction

The act of insurgency has become a reason why millions of school children, especially in the North-Eastern Nigeria are caught up in the conflict situations resulting in a number of insecurity challenges. This tends to have negative impacts on their educational development, the development of their immediate community, as well as on the society at large (Amalu, 2015). This accounts for the rise in different kinds of threats, such as armed robbery, kidnapping, political thuggery, ethno-religious conflicts, organized violent groups, economic-based violence, gender-based violence, sexual abuse, human trafficking and the menace of Boko-Haram, which threatens both human capital and economic developments (Awortu, 2015). Therefore, many experts believe that the answer to these challenges lies in the educational opportunities embedded in practical skills and knowledge development, which are indispensable for employment generation, social inclusion and job creation as a catalyst for national progress (Okeke, Chukwudebelu & Idike, 2016).

There are several of such opportunities that could be used to revise the negative trends associated with insurgency. Capacity building is one of such opportunities. This refers to the skills, knowledge, relationships, values and attitudes that are acquired through a process of development that enables countries, organizations, groups and individuals to carry out functions that could lead to the achievement of their full potential (Onwujekwe et al., 2020). In other words, if many individuals currently engaged in dangerous acts of armed robbery,

kidnapping, political thuggery, ethno-religious conflicts, organized violent groups, economic-based violence, insurgency (Awortu, 2015), are given educational opportunities in capacity building, their lives could turn around and thereby paving way for national reconstruction and reconciliation processes.

There is no doubt that Nigeria is more divided as a result of insurgency and ethno-religious crises that have rocked the nation since the return of democracy in 1999 and it is affecting the entire nation negatively (Read, 2017). Many factors could be attributed to this such as school drop-out, illiteracy, and unemployment, which could still be remedied. For instance, Adeniran (2015) explains that adult and informal education are gateways for providing educational opportunities for those that could not complete their education initially and this could address the challenges of national reconstruction and reconciliation processes. In other words, a successful reconstruction requires changing both preferences and opportunities so that members of the society can cooperate with the government to cement social interaction with one another, and with the nation at large (Okeke et al., 2016). This means that naturally it is expected that in a good social setting, people should act cooperatively in line with the principles of democracy, and this can only happen if individuals are empowered to provide for themselves and to contribute to the social setting within their legal boundary.

Reconciliation on the other hand connotes a process whereby two antagonistic states or parties becoming friends and reaching peace, without any need of overcoming earlier security dilemma (Wu & Yang, 2016). In other words, it implies learning to forgive one another and pushing on with the attainment of certain shared common vision, mutual healing and harmony. This also implies that an individual who was initially hurt due to perceived devaluation but equipped with skills through capacity building opportunity as a way of reintegration into the system should be able to give room for a reconciliation process in the interest of peace and harmony (Onwujekwe et al., 2020). The onus now falls on government and relevant stakeholders to embark on means of providing capacity building opportunities to the majority so that the enormous challenges hindering national reconstruction and reconciliation could be addressed for peace and harmony to return once again to the North-Eastern Nigeria that has been devastated by insurgency.

Educational Capacity Building Opportunities

The concept of education could be viewed from different perspectives. It could be seen as an organized process concerned with the communication of knowledge, acquisition of skills, and with formation of right attitudes to bring about changes, which can benefit an individual and the society at large (Adeniran, 2015). According to Boit, Njoki and Chang'ach (2012), the purpose of education is to equip the citizens with the right skills to reshape their lives, the society and eliminate inequality that could bring about disharmony. Many individuals tend to suffer deprivation as a result of not having full opportunity to functional education, which now causes various social challenges in Nigeria (Eric, 2012).

Thus, failure of any society to address the education of its citizens is equivalent to planting a discord that could explode in the future. However, since education is a continuous process, all hope is not lost based on the fact that through capacity building, a kind of hope could be reignited to help those who could not be educated earlier (Raja, Furqan & Khan, 2011). Capacity building opportunity being provided by educational institutions now contribute in the requisite manpower development to support the productive and service industries of many nations (Sarheng, 2013). It is also a systematic development of knowledge, skills and

behavioural requirements by individuals to adequately perform a task or job (Shaheen, Naqvi & Khan, 2013).

Capacity building opportunity or training could be in vocational and technical education, basic literacy programs, continuing education, information and communication technology (ICT) training skill acquisition and trade training. For example, Ayalew (2011) asserts that vocational and technical education is a form of education whose primary objective is to prepare persons for employment in recognized occupations, either as employees or employers of labour. This implies that capacity building opportunity in ICT could also address the quest for skill development in individuals. Moreover, special programs for capacity building were also introduced in Northern Nigeria such as nomadic education and 'Almajiri' schools to provide unfettered access to quality basic education for the nomads and to boost their literacy (Opejobi, 2017). This was inspired by the value of education, which is lacking in the region compared to other regions and thereby limiting the opportunities of the 'Almajiris,' who are migrants that are in search of Islamic education.

The Concepts of National Reconstruction and Reconciliation

There is no doubt that Nigeria needs national reconstruction and reconciliation process. This is because conflict more often than not destroys physical infrastructure, induces the best human capacities to seek refuge abroad so as not to be killed; weakens networks of civic engagement; reduces service delivery capacities, and inhibits the functioning of governance structures, especially democratically accountable mechanisms at all levels (Onwujekwe et al., 2020). The implication is that reconstruction process is imperative through providing opportunities for youth development, employment generation and poverty reduction (Obi, 2015).

In a nutshell, national reconstruction implies re-erection of the failed structure (s) so that the new structures and capabilities could be built on a solid developmental pillar (Okeke et al., 2016). This means empowering individuals with skills will enable them to address their basic needs. Such opportunities should enable them to contribute to social reconstruction and national development processes, and engender tolerance among ethnic and religious groups in the country (Obunadike, Uzochina & Ughamadu, 2015). National reconstruction therefore represents a process of healing from turbulence and national challenges.

National reconciliation also involves a process of cementing frosty relationships. According to Tshuma (2018), few authors agree on what constitutes process of reconciliation or how to achieve it. Skaar (2013) explains that reconciliation process may be seen as a moral, political or religious concept, and it is important to note that coming to terms with the past is considered a precondition for building peace and future relationships. Many authors agree that reconciliation describes a process rather than an end aimed at building relationships between individuals, groups and the society (Skaar, 2013). Reconciliation therefore remains a process through which a society moves from a divided past to a shared future that restores confidence (Wu & Yang, 2016).

Reconciliation at the national level should be geared towards addressing loss of trust, intergenerational transmission of trauma, grievances and negative interdependence, as well as entailing the repair and restoration of relationships. It also involves dealing with the past, taking responsibility and acknowledging wrongdoing (Skaar, 2013). This is where the government of Nigeria should own up for failing in some certain aspects that led to the conflict situations the nation found itself. This means that the government needs to find a way

of providing capacity building opportunities to empower those that have been denied the opportunity initially for a proper reconciliation process to take place.

Statement of the Problem

Many youths, especially in the North-Eastern Nigeria are vulnerable due to the incidences of insurgency that made many of them to drop-out of school. Many of such youths are now idle and thereby experiencing unemployment and lack of basic needs in life. This dangerous trend could make them to be susceptible to recruitment into acts of armed robbery, kidnapping, and insurgency, which a responsible government should be able to address (Omar, 2011). The seeming bad situation now affects the people in North-Eastern Nigeria and the entire nation in general. Given the above, this paper examined whether or not the educational capacity building opportunities could address national reconstruction and reconciliation processes in Nigeria.

Purpose of the Study

This study examined the educational capacity building opportunities, national reconstruction and reconciliation processes in Nigeria. The specific objectives were to:

4. Identify educational capacity building opportunities that are available in Nigeria;
5. Find out how educational capacity building could impact national reconstruction process in Nigeria;
6. Examine how educational building capacity could impact national reconciliation process in Nigeria.

Research Questions

This study therefore made an attempt to answer the following research questions:

1. What are the educational capacity building opportunities that are available in Nigeria?
2. What are the ways through which educational capacity building impacts national reconstruction process in Nigeria?
3. What are the ways through which educational building capacity impacts national reconciliation process in Nigeria?

Hypotheses

The following hypotheses were formulated to guide the study:

Ho₁: There is no significant relationship between educational capacity building opportunities and national reconstruction process in Nigeria.

Ho₂: There is no significant relationship between educational capacity building opportunities and national reconciliation process in Nigeria.

Methodology

The research design adopted in this study was descriptive survey. A descriptive survey is a method often used to study a sample of a population for the purpose of making generalization about the nature of the entire population from which the sample is selected (Check & Schutt, 2016). This design is therefore appropriate for this study because of the nature of the population, which the study is focused upon. The population of the study was 2987 2018 Batch B National Youth Service Corps (NYSC) members in Abuja Metropolis, Nigeria. The sample size of 299 was selected from the population through simple random sampling method, which is a sampling process in which respondents have equal opportunity to be selected at random without following a particular order (Thomas, 2020). The instrument used for data collection was a questionnaire developed by the researchers, which were administered by research assistants. The questionnaire contains a four-point Likert scale of

fifteen (15) items. The questionnaire items were arranged in three sub-headings. The instrument was given to two specialists in Educational Administration and Planning for validation. Their corrections formed the basis of the final instrument used for the main study. To ensure content validity, a pilot test was carried out by administering the instrument to 50 youth corps members in some selected senior secondary schools in Abuja Metropolis. The test was calculated using the Lawshe Content Validity Index, thus, CRV of 0.81 was obtained. The opinion of the experts and the result of the pilot test proved the validity and reliability of the instrument. Mean and frequency were used to answer the research questions, while Pearson's product-moment correlation coefficient was used to test the hypotheses at 0.05 level of significance. The mean rating of each questionnaire items was determined by scoring each response as follows: Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1. Mean score of 2.5 and above implies an acceptance or agreement while any mean value less than 2.5 signifies disagreement (Bhandari, 20200. The Pearson's Product-Moment Correlation coefficient result was interpreted in such a way that a null hypothesis was rejected if the p-value was less than 0.05 level of significance, and not rejected if the p-value was greater than 0.05 level of significance.

Results

Research Question 1

What are the educational capacity building opportunities that are available in Nigeria?

Table 1 shows items on educational capacity building opportunities from the questionnaire.

Table 1: Educational Capacity Building Opportunities

		SA	A	D	SD		Decision
1.	Vocational and technical education.	106	114	40	39	2.96	Agree
2.	Basic literacy and continuing education programs.	119	104	35	41	3.01	Agree
3.	Training in information and communication technologies (ICT).	129	100	33	37	3.07	Agree
4.	Skill acquisition and trade training.	110	118	40	31	3.03	Agree
5.	Nomadic education and alma Jiri schools.	109	110	37	43	2.95	Agree
						3.00	Accept

Table 1 showing questionnaire items 1, 2, 3, 4 and 5, with mean scores of 2.96, 3.01, 3.07, 3.03 and 2.95 respectively shows an agreement. In conclusion, the overall mean scores of 3.00 implies that the respondents accepted that the various educational capacity building opportunities that are available in Nigeria include vocational and technical education, basic literacy and continuing education programs, training in information and communication technologies (ICT), skill acquisition and trade training, nomadic education and alma Jiri schools.

Research Question 2

What are the ways through which educational capacity building impacts national reconstruction process in Nigeria?

Table 2 shows items on ways through which educational capacity building impacts national reconstruction process from the questionnaire.

Table 2: Ways Educational Capacity Building Impacts National Reconstruction Process

		SA	A	D	SD	\bar{x}	Decision
6.	Addressing the perceived hurt in order to enthrone social reconstruction and national development.	117	116	36	30	3.07	Agree
7.	Reinvesting in human capital.	115	123	32	29	3.08	Agree
8.	Revitalizing social capital and economic growth.	124	103	32	40	3.04	Agree
9.	Reestablishing institutional infrastructure.	115	110	38	36	3.02	Agree
10.	Rehabilitating physical infrastructure.	116	119	39	25	3.09	Agree
						3.06	Accept

Table 2 showing questionnaire items 6, 7, 8, 9 and 10, with mean scores of 3.07, 3.08, 3.04, 3.02 and 3.09 respectively shows an agreement. In conclusion, the overall mean scores of 3.06 implies that the respondents accepted that the ways through which educational capacity building impacts national reconstruction process in Nigeria include addressing the perceived hurt in order to enthrone social reconstruction and national development, reinvesting in human capital, revitalizing social capital and economic growth, reestablishing institutional infrastructure, and rehabilitating physical infrastructure.

Research Question 3

What are the ways through which educational building capacity impacts national reconciliation process in Nigeria?

Table 3 shows items on ways through which educational capacity building impacts national reconciliation process from the questionnaire.

Table 3: Ways Educational Capacity Building Impacts National Reconciliation Process

		SA	A	D	SD	\bar{x}	Decision
11.	To deal with the past, taking responsibility and acknowledging wrongdoing.	121	107	35	36	3.05	Agree
12.	To cementing frosty relationships between individuals, groups and societies.	108	112	40	39	2.97	Agree
13.	To point at the moral, political or religious burden of building peace and future relationships.	118	116	30	35	3.06	Agree
14.	To address loss of trust and intergenerational transmission of trauma.	117	110	34	38	3.02	Agree
15.	To address grievances and negative interdependence so as to restore confidence in one another.	114	104	37	44	2.96	Agree
						3.01	Accept

Table 3 showing questionnaire items 11, 12, 13, 14 and 15, with mean scores of 3.05, 2.97, 3.06, 3.02 and 2.96 respectively shows an agreement. In conclusion, the overall mean scores of 3.01 implies that the respondents accepted that educational capacity building impacts national reconciliation process in Nigeria by helping to deal with the past, taking responsibility and acknowledging wrongdoing, cementing frosty relationships between individuals, groups and the society, pointing at the moral, political or religious burden of building peace and future relationships, addressing loss of trust and intergenerational

transmission of trauma, and addressing grievances and negative interdependence so as to restore confidence in one another.

Hypotheses

H₀₁: There is no significant relationship between educational capacity building opportunities and national reconstruction process in Nigeria.

Table 4 shows the items on educational capacity building opportunities and national reconstruction process as generated from the research questionnaire and calculated using SPSS.

Table 4: Relationship between Educational Capacity Building Opportunities and National Reconstruction Process

r	Sig. (2-tailed)	df	Decision
.361	.000	12	Significant

**P < 0.05 level of significance*

Table 4 shows the results of the test of significant relationship between educational capacity building opportunities and national reconstruction process in Nigeria. The coefficient obtained was 0.361, with a p-value = 0, which is less than the critical value at 0.05 level of significance and degree of freedom = 12. Therefore, the null hypothesis was rejected. This means that a significant relationship exists between educational capacity building opportunities and national reconstruction process in Nigeria.

H₀₂: There is no significant relationship between educational capacity building opportunities and national reconciliation process in Nigeria.

Table 5 shows the items on educational capacity building opportunities and national reconciliation process as generated from the research questionnaire and calculated using SPSS.

Table 5: Relationship between Educational Capacity Building Opportunities and National Reconciliation Process

r	Sig. (2-tailed)	df	Decision
.353	.000	12	Significant

**P < 0.05 level of significance*

Table 5 shows the results of the test of significant relationship between educational capacity building opportunities and national reconciliation process in Nigeria. The coefficient obtained was 0.353, with a p-value = 0, which is less than the critical value at 0.05 level of significance and degree of freedom = 12. Therefore, the null hypothesis was rejected. This means that a significant relationship exists between educational capacity building opportunities and national reconciliation process in Nigeria.

Discussion

Analysis of research question one (Table 1) established that the various educational capacity building opportunities available in Nigeria include vocational and technical education, basic literacy and continuing education programs, ICT training, skill acquisition and trade training, nomadic education and 'Almajiri' schools. This agrees with the work of Ayalew (2011) who

asserts that vocational and technical education is a form of education whose primary objective is to prepare people either as employees or employers of labour. Also, Opejobi (2017) affirms that the Jonathan administration constructed model Alma Jiri schools in order to tackle the high rate of illiteracy in the Northern region.

Analysis of research question two (Table 2) revealed that educational capacity building could impact national reconstruction process by addressing perceived hurt in order to enthrone social reconstruction and national development, reinvesting in human capital, revitalizing social capital and economic growth, reestablishing institutional infrastructure, and rehabilitating physical infrastructure. This is in line with Sarbeng (2013) who affirms that the process of reconstruction should be by way of re-establishing institutional infrastructure; rehabilitating physical infrastructure; reinvesting in human capital; revitalizing social capital; and regenerating economic growth. Shaheen, Naqvi and Khan (2013) also state that capacity building should contribute to systematic development of knowledge, skills and behavioural change, which ensures effective citizenship.

Analysis of research question three (Table 3) affirmed that educational capacity building impact national reconciliation process by helping to deal with the past, taking responsibility and acknowledging wrongdoing, cementing frosty relationships between individuals, groups and societies, pointing at the moral, political or religious burden of building peace and future relationships, addressing loss of trust and intergenerational transmission of trauma, addressing grievances so as to restore confidence in one another. This agrees with the work of Wu and Yang (2016) who posit that reconciliation entails a process whereby two antagonistic states or parties becoming friends and reaching peace, without any need of overcoming earlier security dilemma. This is also in agreement with Skaar (2013) who concludes that first reconciliation entails the repair and restoration of relationships, while the second aspect of reconciliation involves dealing with the past, taking responsibility and acknowledging wrongdoing.

Conclusion

Based on the above, the paper concludes that the various educational capacity building opportunities available in Nigeria include vocational and technical education, basic literacy and continuing education programs, training in ICT, skill acquisition and trade training, nomadic education and Alma Jiri schools. Therefore, a significant relationship exists between educational capacity building opportunities, national reconstruction and reconciliation processes in Nigeria. The implication of this is that by widening the scope of educational capacity building opportunities to the volatile areas, the government could actualize developmental process that can bring peace and national rebirth in terms of reconstruction and reconciliation in Nigeria.

Recommendations

Based on the findings, the following are some of the recommendations reached:

1. The Nigerian government should ensure that the opportunities in capacity building such as vocational and technical education, basic literacy and continuing education programs, training in ICT, skill acquisition and trade training, nomadic education and Alma Jiri schools are extended to every zone so that people who never had opportunity to go to school initially could avail themselves the opportunity to improve on their economic well-being so as not to be idle.
2. National reconstruction process should be addressed adequately, especially by reinvesting in human capital development so that perceived hurt in some quarters

could be addressed so as to enthrone social reconstruction, build social capital and economic growth, as well as enthrone national development.

3. National reconciliation process should be addressed in such a way that the past should be dealt with adequately in order to cement all frosty relationships between individuals, groups and the society, as this will bring about the building of lasting peace and addressing loss of trust, grievances and promoting restoration of confidence in one another so as not to seek revenge.

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EFFECT OF PHYSICAL MANIPULATIVES ON LEARNERS' UNDERSTANDING OF SURFACE AREA AND VOLUME OF PRISMS

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Abstract

Research highlights that learners have difficulties in comprehending the difference between surface area and volume of prisms. The study sought to explore the effect of physical manipulatives on learners' understanding of surface area and volume of prisms. The concurrent design exploratory case study which employed both quantitative and qualitative research methods provides a comprehensive analysis of the research problem. Simple random sampling was used to select eighteen learners to participate in the study. The diagnostic test was administered to explore learners' difficulties and the post-test was then administered to evaluate the intervention which made use of physical manipulatives in trying to address the identified problems. GeoGebra Classic 5 software was utilised to conduct the paired t-test differences of the data. Semi-structured interview responses were transcribed and reported in themes and descriptive script. This study revealed that there is a significant effect on the use of physical manipulatives to teach surface area and volume of prisms. Therefore, the study recommends that mathematics teachers integrate physical manipulatives when teaching to enhance learners' understanding of surface area and volume of prisms.

Keywords: *physical manipulatives, teaching and learning, surface area of prism, volume of prism*

Introduction

Mathematics competences are important for social and economic development. Despite the importance of Mathematics in real life, South African learners still struggle to reach the competency level. According to Trends in International Mathematics and Science Study (TIMSS) report of 2016, only one-third of South African learners achieved a Mathematics and Science score above the benchmark of 400 points, a score denoting the minimum level of competence. Research calls for Mathematics teachers to design and implement robust interventions in most of the Mathematics curriculum topics, to improve learners' performance (Reddy, Visser, Winnaar, Arends, Juan, Prinsloo & Isdale, 2016). Measurement is one of the topics that need interventions, since it plays an integral role in every person's life, for example, in the kitchen, in building, carpentry, medicine careers and other real-life activities. Despite the importance of measurement in real-life applications, most learners cannot proficiently differentiate the calculation of surface area from the volume of prisms.

To ensure that surface area and volume concepts make sense to the learners, teaching should be connected to real-life situations. Even though the surface area and volume concepts are embedded into humans' day-to-day activities, research has demonstrated that many learners do not make sense of the attributes being measured or the units that are used for surface area and volume (Goos, Brown & Markar, 2008). Most learners lack understanding of basic skills such as spatial attributes and the use of informal and formal units to measure; and comparison

of quantities, and this results in learners' struggling in calculating surface area and volume of prisms. In teaching about area and volume of prisms, teachers should not just give learners formulae to compute without developing the basic understanding of various polygons, learners have to reason about the concept using hands-on activities. This implies that before teaching abstract concepts, for example, the use of standard units and physical manipulatives, there is need to concretise abstract concepts (Enki, 2014; Kontas, 2016) to promote conceptual understanding and procedural fluency.

Problem statement

To date, many researchers have explored the effects of using hands-on materials on Mathematics instruction to improve learners' academic achievement (Kul, Çelik & Aksu, 2018), but there is limited literature reporting on the use of physical manipulatives when learning the concepts, surface area and volume of prisms. Therefore, this article seeks to explore the effect of using physical manipulatives on learners' understanding of surface area and volume of prisms.

Research question

The study sought to answer the question: what is the effect of physical manipulatives on learners' understanding of surface area and volume of prisms?

Objective

The study sought to investigate the effect of physical manipulatives in the understanding of surface area and volume of prisms.

Hypothesis

The following null hypothesis was tested at 0.05 level of significance.

H₀: There is no significant effect on the use of physical manipulatives on learners' understanding of surface area and volume of prisms.

Literature review

Physical manipulative is defined as any material or object from the real world that learners can manipulate to present a mathematical concept. Physical manipulatives are appealing to several senses and they can be concrete and digital (computer-based application) (Cope, 2015). Manipulatives are regarded as mediators of learning in the Mathematics curriculum in most countries. Teachers' explicit explanation of lesson objectives makes physical manipulatives used beyond instruments of play and entertainment from the perspective of a learner (Kontas, 2016).

Numerous studies established that the integration of manipulatives in learning and teaching of Mathematics enhances learners' learning unlike teaching without them (Sarama & Clements, 2016). This suggests that teaching of surface area and volume of prisms should be accompanied by physical manipulatives to alleviate alternative conceptions and enhance learning. Morgan, Farkas and Maczuga (2015) argue that the utilisation of manipulatives puts much emphasis on conceptual understanding and enhances learners' coordinated realisation of mathematical concepts.

Other researchers argue that the utilisation of physical manipulatives in the teaching and learning of Mathematics guarantees worthwhile learning of Mathematics (Carbonneau, Marley & Selig, 2012). Worthwhile learning includes discovering and managing consistent

settings for learners' scholarly improvement (Cai, 2003). Besides, the utilisation of physical manipulatives advances discovery learning of mathematical concepts through unstructured learner determined investigation which results in robust learning (Piaget & Coltman, 1974). Evidence from the consolidated instructional guidance literature has demonstrated that the instructional guided learning produced results that were considerably more prominent in execution than pure discovery learning (Alfieri, Brooks, Aldrich & Tenenbaum, 2011). The use of physical manipulatives in Mathematics teaching and learning bridges the gap between informal and formal Mathematics, stimulates active participation (Boggan, Harper & Whitmire, 2010) and provides equal opportunities among learners. In addition, physical manipulatives allow transition from concrete to symbolic, promote learners' retention in understanding surface area and volume, allow learners to acquire skills such as reasoning, manipulation, teamwork, observation, psychomotor to reason and drive generalisation through concrete experiences (Kontas, 2016).

Conversely, there have been inconsistencies in the discoveries of the research investigating the integration of physical manipulatives into the teaching and learning of Mathematics. Some studies discovered that manipulatives support learning, while others established that they impede learning (Gürbüz, 2010). Carbonneau, et al's (2013) meta-analysis of 55 studies on instructional procedures uncovered that manipulatives can only profit learners when strategically incorporated into teaching and learning. Mendiburo and Hasselbring (2014) report that the 1600 learners who utilised manipulatives for 28-30 days were more prolific in the post-test, retention test, conceptual understanding, ordering and estimation than those who did not utilise manipulatives. Despite the combined outcomes in the use of manipulatives in teaching and learning, analysts recommend that the application of the Montessori technique for the utilisation of manipulatives advances Mathematics learning (Laski, Jor'dan, Daoust & Murray, 2015).

Theoretical framework

Kilpatrick, Swafford and Findell (2011) model of mathematical proficiency was utilised to investigate how the utilisation of physical manipulatives affects the learning of surface area and volume. Kilpatrick et al's (2001) model of mathematical proficiency is comprised of five interwoven strands, namely: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition. This paper focuses on the first two strands. Conceptual understanding refers to the unified and purposeful comprehension of mathematical concepts while procedural fluency entails learners' ability to discern when and how to estimate and use acquired skills flexibly, accurately and efficiently in a mathematical set up (Kilpatrick, et al, 2001).

Methodology

Knowing that all single methods have restrictions and bias, the mixed-methods approach was employed in this study (Creswell, 2003). The concurrent design has been applied as an exploratory case study which employed both quantitative and qualitative research methods to carefully provide a complete analysis of the research problem (Creswell, 2003). GeoGebra Classic 5 software was utilised to conduct the T-test paired differences; and semi-structured interview responses from six purposefully selected learners were transcribed, annotations identified and then themes were identified from the interview annotations and reported in themes as a descriptive script.

Participants

From the cohort of 56 Grade 8 learners, 18 (8 males and 10 females) were selected using simple random sampling to participate in the study, they were of mixed sexual orientation (age range from 13-16). Simple random sampling gives every individual an equal chance of being selected in the sample from the population. The school where the research is one of the secondary schools in the Queenstown District in the Eastern Cape Province of South Africa. Six learners were purposefully selected for semi-structured interviews depending on their performance in the post-test; three girls and three boys were put into three categories as follows; (i) two whose marks were the highest in the post-intervention test (ii) two whose marks were average, and (iii) two whose marks rated poorly (below average).

Data collection

Data were collected from both the diagnostic test and post-test results. The diagnostic test explored learners' difficulties and the post-test evaluated the effectiveness of the intervention employed. The intervention had four tasks which aimed at dealing with the identified problems. Learners' responses to the diagnostic and post-test provided the quantitative data for the study while semi-structured interview responses provided the qualitative data which were transcribed and reported in themes and descriptive script.

Validity

Validity involves two concepts concurrently, the accurate interpretation of the results (internal validity) and the extent to which the results can be generalised (external validity).

Internal validity

Every study has threats to internal validity such as history, maturation, selection bias, implementation, data collector bias and data collector characteristics. To minimise the history incidences, we interviewed all the participants within the same day. To reduce the effects of maturation, which is the advanced development of the participants, the concurrent exploratory case study design which provides the opportunity of studying a particular phenomenon within a restricted time frame was employed (Bells, 1993).

The threats of selection bias and data collector bias were dealt with by employing simple random sampling. To avoid the threat of data collector characteristics like age and gender from affecting the results of the study, we collected data ourselves from all the learners. When learners' responses were not clear, the researchers did member checking as a means of external validation (Lewis & Ritchie, 2003).

External validity

Three factors considered in this study as threats to the external validity include: history effects, setting effects and construct effects. The strategies and procedures which were employed to avoid these threats are discussed below.

History effects: the background of the participants was known and acknowledged. In this study, it was noted that learners were selected using simple random sampling from a cohort of 56 eighth-grade learners. To deal with setting effects, the study involved only the learners enrolled in a South African high school system and were taught the same Mathematics content.

Construct effects is the degree to which abstract expressions, overviews, or connotations are shared across times, sceneries, and populations (Le Compte & Goetz, 1982). This threat was

dealt with as follows: all the learners in the study were familiar with measurement syllabus set by South Africa's Department of Basic Education. Both diagnostic tests and post-tests were piloted using learners from the same research site. Semi-structured interviews, diagnostic tests and post-intervention tests were authorised by Rhodes University's ethics committee. Intervention activities were aligned to Kilpatrick, et al's (2011) model of mathematical proficiency.

Instrument validation

Regarding the diagnostic and post-intervention tests, we involved the head of the Mathematics department at the study site and district subject specialist for Mathematics in the district to analyse and validate the questions to ascertain if they were appropriate in terms of content and grade level. In addition, *the diagnostic test was piloted using a group of seven eighth grade learners to guarantee the standard.*

Reliability

Bloor and Wood (2006) define reliability as the degree to which research findings are reproduced under the same methodology by different researchers and give the same results. To address the issue of reliability in the study, the following steps were considered, as suggested by Shenton (2004):

(i) The research design and its execution, describing what was planned and executed on a strategic level; (ii) the operational detail of data gathering, addressing the intricacies of what was done in the field; (iii) reflective appraisal of the study, evaluating the effectiveness of the process of inquiry undertaken (p.71).

Detailed findings from the semi-structured interviews have been reported and also GeoGebra Classic 5 software was utilised to conduct the t-test difference of means to answer the research questions and to test the null hypothesis of the study.

Mechanical recording equipment was utilised in voice and video recordings during interviews to help during the coding and for future use by any researcher who might require the information in details.

All the procedures of data analysis were well documented so that other researchers can follow the process in the form of an audit trail at any time.

The intervention programme comprised four tasks as shown below:

Intervention task 1

In this task, learners were asked:

- To draw a square and a rectangle on the provided square-grid papers.
- To find the number of squares in the area covered by the square and a rectangle
- To investigate another way of finding the number of squares that cover the region occupied by each of the shapes drawn on the grid paper.
- To use the squares (tiles) provided to answer the questions that follow:
 - Make up a square with:
 - (i) 10 tiles (ii) 25 tiles (iii) 16 tiles
- To determine the number/s of tiles managed to give them square shapes

- To explain why other numbers of tiles could not do this
- To find out the number of rectangles can be formed using:
 - (i) 10 squares? (ii) 7 squares? (iii) 12 squares?
- To tile (using squares and triangle tiles) the surfaces of a square and the rectangle with the provided tiles blocks and then record the findings: using responses; possible or impossible

Intervention task 2

Task 2 comprised of five questions that expected learners to draw on the grid paper the nets of a cube and a rectangular prism, these were subsequently folded into the significant cubes and rectangular prisms. This task was aimed at helping learners to compute the surface area of the cube and the rectangular prism informally.

Learners were to do the following activities:

- To use the provided grid papers, draw the net of:
 - a) a cube measuring 4 squares per side.
 - (b) A rectangular prism with dimensions: 4 squares in length, 3 squares in breadth and
 - To determine the number of the squares covering the surface of each of the two nets.
 - To explain how they manage to get the total number of squares on the surface of each net
 - To investigate another way of finding the total number of squares on the surface of each of the nets.

Intervention task 3

Intervention task 3 focussed on visualisation and the naming of solid shapes and counting the number of faces of the solid.

Learners were asked to do the following activities:

- To name the two objects drawn (a cube and a rectangular prism)
- To identify the number of faces on each of the objects
- To measure and record the dimension of each of the objects
- To draw the net of the two objects on a grid paper and then fold each net inside out
- To determine the length, breadth and height of each object to calculate the volume

Intervention task 4

The fourth task focussed on the concept of volume of a cube and a rectangular prism. It involved questions that engaged learners in the calculation of the volume of cubes and rectangular prisms by filling boxes with dice.

Learners were also asked to use the dice and the boxes provided to do the following activities:

- To find out how many cubes each of the boxes can hold, record your findings.
- After that to explain how did they find the number of cubes that exactly fit into (a) a cube? (b) a rectangular prism
- To investigate and write another method that could help them to find the number of dice that fit into each of the given boxes.

Figure 1 below shows a summary of how learners were engaged in the use of physical manipulatives.

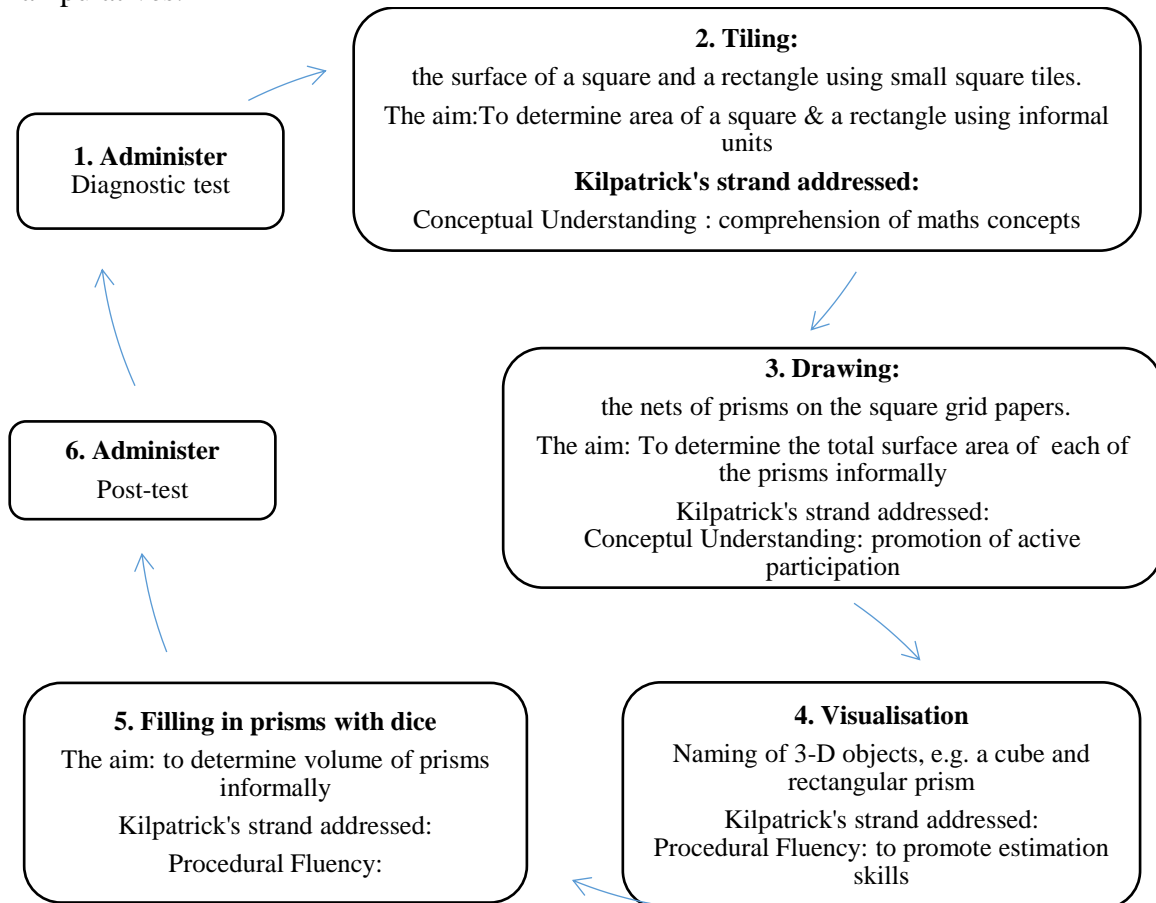


Figure 1: shows how the use of physical manipulatives in the intervention was linked to Kilpatrick's two strands of mathematical proficiency

Ethical considerations

For ethical considerations: Letters of consent were written to Queenstown Department of Education, the school principal and the school governing board. After piloting the diagnostic test, participants were randomly identified, letters and forms of consent were sent to their parents and guardians of the research participants requesting consent for their children to take part in the research project. Parents and guardians signed the letters and were brought back to the researchers. To avoid unnecessary absenteeism and dropout of the participants, the

participants’ guardians were informed of their liberty to withdraw their children from the project at any time.

Data analysis

The data from the semi-structured interviews were manually transcribed and then analysed thematically. Thematic analysis was guided by Kilpatrick et al.’s (2001) notion of conceptual understanding and procedural fluency. Thematic analysis is aimed at systematically identifying, scrutinising and giving an account of the identified themes describing how the utilisation of physical manipulatives enhanced learners’ proficiency of surface area and volume concepts. GeoGebra Classic 5 software was utilised to conduct T-test, paired differences to answer the research question and to test the null hypothesis of the study.

Results

Table 1 below shows the t-test difference of means of the Diagnostic and Post-test results.

Table 1: T-test paired differences analysis of the effect of physical manipulatives on learners’ understanding of surface area and volume.

Test	n	Mean	Minimum	Maximum	Standard Deviation (SD)
DT	18	22.8	0	44	13.269
PT	18	31.1	0	52	16.764

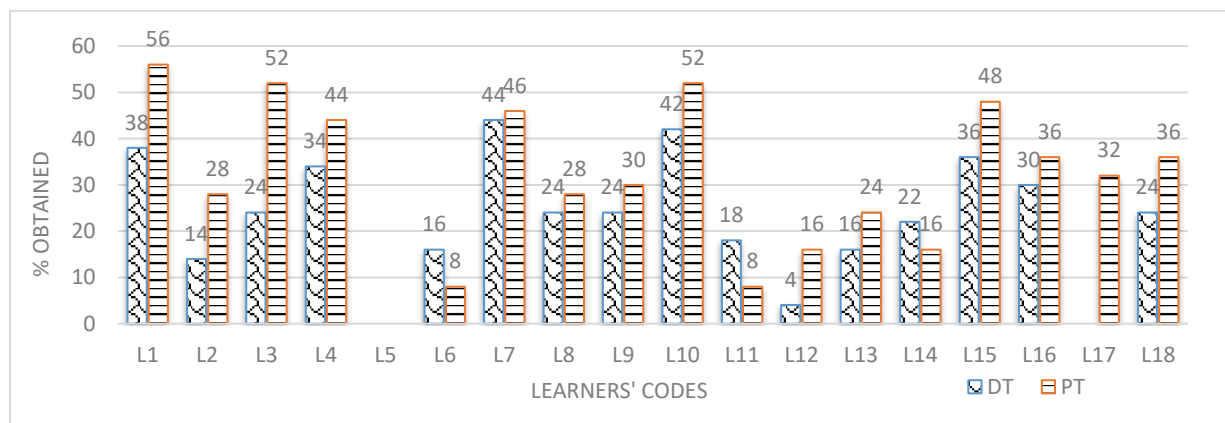
Note: Note: df, 17; t-value, -3.2071; p-value, 0.0052; SE, 2,5984; Mean difference, -8.333

From Table 1 above, it can be noted that the values of df, 32.966; t-value, -3.2071; p-value, 0.0052; SE, 5.0394; difference, -8.333 are not significant at $p < 0.05$. Since $p < 0.05$, therefore, there is sufficient evidence to reject the null hypothesis:

H₀: There is no significant effect on the use of physical manipulatives on learners’ understanding of surface area and volume of prisms.

We therefor accept the alternative hypothesis:

There is no significant effect on the use of physical manipulatives on learners’ understanding of surface area and volume of prisms.



Note: Diagnostic Test (DT);

Post-test (PT)

Figure 2: A graph showing learners’ overall performance in both DT and PT

Figure 2 shows the comparison of DT and PT results. The summary of the comparison of the two tests is presented below.

Learners who improved: L1; L2; L3; L4; L7; L8; L9; L10; L12; L13; L15; L16; L17 & L18

Learners who did not improve: L5, L6, L11 and L14.

As shown in Figure 2; 78% (n = 14) of the learners improved in their performance in PT and 22% (n = 4) did not improve.

Discussions of the findings

The study has shown that the integration of physical manipulatives in the teaching and learning of surface area and volume of prisms benefits the learners. The outcomes of the t-test of differences of means have confirmed that physical manipulatives have the potential to enhance learners' mathematical proficiency. These findings are in agreement with previous researchers' findings (Carbonneau, Marley & Selig, 2012; Morgan, Farkas and Maczuga, 2015; Sarama & Clements, 2016;) To respond to the research question, themes have been identified from learners' views expressed during the semi-structured interviews. Worth noting are the themes below that were generated from the respondents' data.

Theme 1: Bridging the gap between formal and informal

Different learners' responses during the interview highlighted the advantages of integrating physical manipulatives; L2 said that:

.... physical manipulatives helped me to learn the concepts of surface area and volume better than before because we didn't use them. I had to find the surface area just by counting the total number of squares on the surface of each of the boxes. And then we filled each of the prisms with the dice in order to find how many dice each of the prisms could hold. This did not need us to think deeply because the materials you gave us made things easy.

Commenting on how the physical manipulatives were used in the learning of surface area and volume, L1 said that:

I counted the number of squares covering one of the faces of a cube and multiplied it by 6 to find the total number of the squares on the surfaces of a cube because all the faces of the cube are squares and they have the same number of squares covering each region. For volume, I found out that the number of dice each box held was its volume.

L1 and L2's comment are similar to those of Kontas (2016) who found out that physical manipulatives allow learners' transition and understanding of concepts from concrete to symbolic.

Theme 2: Active participation-team work

L2 and L5 felt that the use of physical manipulatives made them to be active participants in the classroom, they said that:

The physical manipulatives were so engaging that we were able to discuss and share ideas when doing the tasks. The materials you provided helped us to work with what we could really see and made us discuss the concepts.

The comment by L2 and L5 are in agreement with the study by Carbonneau et al (2012) who unanimously recommended the use of physical manipulatives as a more effective way of helping learners understand mathematical concepts being presented. The utilisation of physical manipulatives enhanced learners' understanding of the surface area and volume of prisms.

Theme 3: Driving generalisation through concrete experiences

Learners who worked with physical manipulatives successfully demonstrated the following: (i) an ability to follow instructions and use physical manipulatives accordingly, (ii) ability to justify their solution, (iii) were able to work as a team, (iv) were able to use other resources to enhance the understanding of mathematical terms, (v) they were actively involved, (vi) they were able to discuss the question, (vii) they were able to differentiate surface area and volume of prisms, and (viii) almost all the learners were motivated to do the task using physical manipulatives. These findings are mirrored in Enki's (2014) study findings where students pointed out that the use of manipulatives when learning Mathematics gave them pleasure and increased their motivation and allowed them to learn while having fun. The research revealed that when physical manipulatives drive generalisations, learners are able to integrate their knowledge and associate them with their judgments in order to comprehend mathematical notions systematically (Boggan, Harper & Whitmire, 2010).

Theme 4: Persistent misconceptions

Although the use of physical manipulatives seemed to be a solution to some learners, to others they could not improve in the post-test, for example, the question that required them to identify a cube and a rectangular prism. The reason for such persistent misconceptions might be: (i) lack of prior knowledge in learning Mathematics using physical manipulatives, (ii) learners' misinterpretation of mathematical representations, for example, the 3-dimensional shapes on a flat surface was perceived as a 2-dimensional, and (iii) insufficient time to engage with physical manipulatives might be another factor.

In support of the findings, L6 said that: *"In some areas, physical manipulatives did not help in learning about surface area and volume of prisms, especially finding the number of squares outside the prisms."*

Conclusion

The use of physical manipulatives has a significant effect on learners' understanding of surface area and volume of prisms. The study also established that the integration of physical manipulatives into the teaching and learning of surface area and volume can serve as tools to simplify some concepts and establish a solid framework for learners' applied comprehension of Mathematics.

Recommendations

In reference to the post-test results in this study, it is clear that the intervention adopted has helped most of the learners to conceptually understand the concepts of surface area and volume of prisms, therefore, the study recommends that Mathematics teachers integrate physical manipulatives when teaching surface area and volume of prisms.

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IMPACT OF TEACHERS' CLASSROOM LEADERSHIP STYLE ON STUDENTS' ATTITUDE TOWARDS LEARNING OF MATHEMATICS IN RIVERS STATE SENIOR SECONDARY SCHOOLS, NIGERIA

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Abstract

This study investigated the impact of teachers' classroom leadership style on students' attitude towards the learning of mathematics in Rivers State senior secondary schools, Nigeria. Three hypotheses were tested at .05 probability level. The correlational design which sought relationship between teachers' classroom leadership style and students' attitude towards the learning of mathematics was employed to conduct the study. Stratified random sampling technique was used to select a sample of 720 senior secondary schools 1, 2 and 3 students from the target population. Instruments used to collect data were titled Teacher Classroom Leadership Style Questionnaire "TCLSQ" ($r = 0.72$) and Student Attitude to Mathematics Learning Questionnaire "SAMLQ" ($r = 0.78$). Linear regression analysis was used to test the null hypotheses. The findings revealed that the authoritative teachers' classroom leadership style yielded a strong and positive relationship with students' attitude towards learning of mathematics and contributed 45.5%, the democratic teachers' classroom leadership style yielded a strong and positive relationship with students' attitude and contributed 64.4% while the permissive teachers' classroom leadership style yielded a weak and negative relationship with students' attitude and contributed 1.60%. The authors therefore recommend that teachers should employ democratic classroom leadership style and at the same time be cautious of derailing the democratic leadership style in order not to elicit undue liberty from students in classroom interaction.

Keywords: Teacher, attitude, leadership style, Mathematics, student.

Introduction

The relevance of mathematics to every aspect of human endeavor is becoming increasingly necessary for individuals, organizations and the society at large. Mathematics is a veritable tool which must be utilized by all to solve everyday problems though at varied degree. The mathematics teacher implements the mathematics curriculum content at the classroom level. The major aim of the teacher should be to prepare students who will develop a positive attitude towards the subject and also excel with respect to performance in the subject. The attitude which students exhibit towards the learning of mathematics is crucial to their performance in the subject. One of the prerequisites for understanding mathematics is the students' attitude toward mathematics and the desire of students to learn it (Khayati & Payan, 2014). One prominent factor that has the capacity to stimulate the attitude of secondary school students in the learning of mathematics is the teacher classroom leadership styles employed by the teachers during classroom instruction.

The teacher is the pilot of the classroom that he/she instructs. It is therefore expected that, teachers display some form of classroom leadership style to direct the classroom atmosphere and activities. Shamaki(2015) stated that leadership style has to do with all the variable that the leader of group will undertake to direct, control, structure and interact with those under his jurisdiction. Leadership style is the technique a leader puts in place to provide direction which will motivate the subordinates when implementing plans. Adams (2015) defined

teacher classroom leadership style as the behavioral pattern which a teacher employs to direct classroom instruction. This behavioral pattern goes a long way to motivate or mar students' attitude towards the subject being taught. Classroom leadership of a teacher is the process of putting checks and balances in the classroom and taking decisions during classroom instruction to ensure that classroom lessons run smoothly without disruption. The type of control a mathematics teacher exercises on the students during classroom teaching is called the mathematics teacher classroom leadership style. It could be either favourable or unfavourable to students.

The classroom leadership style employed by the mathematics teacher in the classroom is widely influenced by the teacher's personality in terms of his/her psychological disposition, academic level, and experiences impacted by his/her academic, social, economic and cultural background (Al Ali & Badah, 2010). This therefore, implies that teachers of mathematics at the senior secondary school should deal with some of their own leadership dispositions before assuming the role of teaching mathematics. The first reason was that the nature and structure of mathematics has presented itself as a difficult, abstract and boring school subject. The second reason is the issue of students having the natural disposition to disrupt classroom atmosphere during instruction.

Yale (2018) posited that there are basically three different leadership styles which every leader can be categorized when dealing with his/her subordinates namely autocratic, democratic and laissez faire. Therefore, this study focused on the three leadership styles deduced from Yale. The autocratic leadership style which is also known as authoritarian leadership style is observed in the classroom when the teacher is in control of activity and entertains little or no input from the students. The autocratic classroom atmosphere places fear in the students, thus causing psychological hang up. The autocratic classroom leadership style grants the teacher the right of passing orders, decision making and providing firm boundaries on the students, thereby establishing a relationship between the student and the teacher that is dominated by fear, obeying and carrying out the instructions without discussion, arguing or interruption. Hoyle (2013) opined that teacher classroom democratic leadership style, the classroom atmosphere is shared and every member of the class participates in the activities. Thus, students exchange views with the teachers and participate in decision making without any attempt to take over the leadership of the classroom from the teacher. The permissive or leisure/laissez-faire classroom leadership style is characterized by giving students freedom to execute what they feel is correct and suitable for them, the teacher does not impose a view over his students.

The research finding of Amalu and Njoku (2018) revealed that there is a significant positive relationship between teachers' leadership style and students' learning motivation in mathematics. Isaac (2011) investigated teachers' leadership styles and students' academic performance in mathematics courses and found out that there was no significant relationship between teachers' leadership styles and students' performance in mathematics. The findings of Mazana, Montero and Casmir (2019) revealed a significant positive weak correlation between students' attitude and performance in mathematics. Gyasi, Xi and Owusu-Ampomah (2016) investigated the effect of leadership styles on learners' performance in the Kwabre District Assembly of Ashanti Region in Ghana and established that respondents agreed that leadership style affect the academic performance of students. The research finding of Nsubuga (2008) revealed that, effective school performance of students requires the use of democratic leadership style by teachers to relate with students and also, there was a strong relationship between visionary leaders who use democratic leadership style and students

performance in academic subjects. Following the above cited research findings, it becomes imperative that the leadership style of mathematics teachers influences students' attitude towards learning mathematics, which in turn influence their academic performance. Thus, the study sought to find out the impact of teachers' classroom leadership style on students' attitude towards learning of mathematics in River State senior secondary schools, Nigeria.

Statement of the Problem

The scientific and technological development of any nation spins around the subject matter of mathematics. This suggests why mathematics is made compulsory in the Nigerian primary and secondary educational system. Despite the huge role which mathematics play in our personal and societal endeavor, students have continuously exhibited poor performance in the subject. Research evidence (Langat, 2015; Ayob, & Yasin; Mensah & Okyere, 2019; Sirmaci, 2010; Toporova, Johansson & Myrberg, 2019) observed that one of the factors that contribute to students' poor performance in mathematics is the negative attitude of students towards mathematics. Given that it is the teachers who carry out mathematics classroom instruction, it therefore becomes imperative that the teacher and students come together under the umbrella of teaching and learning. The teacher employs a combination of pedagogical strategies and classroom leadership styles when imparting mathematical knowledge to students. Students' poor learning outcomes in mathematics have also been linked to several other factors and one continuous pressing concern is the teacher classroom leadership style which greatly enhances or mares the students' attitude towards the learning of mathematics. It is against this backdrop that this investigation was embarked upon to find out whether there is a relationship between teachers' classroom leadership style and students' attitude towards successful learning of mathematics.

Research Questions

1. What is the relationship between teachers' classroom authoritative/autocratic leadership style and the attitude of students towards the learning of mathematics in Rivers State senior secondary schools?
2. What is the relationship between teachers' classroom democratic/facilitative leadership style and the attitude of students towards the learning of mathematics in Rivers State senior secondary schools?
3. What is the relationship between teachers' classroom permissive/laissez -fairre leadership style and the attitude of students towards the learning of mathematics in Rivers State senior secondary schools?

Hypotheses

The following null hypotheses were tested at .05 significant level.

H₀₁: There is no significant relationship between teachers' classroom authoritative/autocratic leadership style and the attitude of students towards the learning of mathematics in Rivers State senior secondary schools.

H₀₂: There is no significant relationship between teachers' classroom democratic/facilitative leadership style and the attitude of students towards the learning of mathematics in Rivers State senior secondary schools.

H₀₃: There is no significant relationship between teachers' classroom permissive/laissez fairre leadership style and the attitude of students towards the learning of mathematics in Rivers State senior secondary schools.

Research Design

The survey correlational research design which sought relationship between teachers' classroom leadership style and students' attitude towards the learning of mathematics was employed to conduct the study.

Population of the study

The population of the study was made up of all 18,463 senior secondary one, two and three students in Port Harcourt Local Government Area of Rivers State, Nigeria.

Sample Size and Sampling Technique

Five schools were randomly sampled, and a stratified random sampling technique was used to select a sample of 48 students from each stratum of Senior Secondary SS1, 2 and 3 from each school. This gave a student ample size of 720.

Instrumentation

Two instruments were used to collect data for the study. The first instrument was titled "Teacher Classroom Leadership Style Questionnaire" (TCLSQ) while the second instrument was titled "Students Attitude to Mathematics Learning Questionnaire" (SAMLQ). Both instruments were non cognitive and each had 15 items. The two instruments had sections A and B. Section A sought information on students' demography. Section B of TCLSQ measured the classroom leadership styles which mathematics teachers employ to teach mathematics in senior secondary schools. Items 1-5 of TCLSQ specifically measured features of the classroom authoritative/autocratic leadership style, items 6 -10 measured features of the classroom democratic/facilitative leadership style while items 11-15 measured features of the classroom permissive/laissez faire leadership style.

Section B of SAMLQ measured the attitude which students exhibit towards the learning of mathematics with respect to particular teachers' classroom leadership styles. Items 1-5 of SAMLQ specifically measured the attitude which students exhibit towards the learning of mathematics when taught by teachers using authoritative/autocratic classroom leadership style, items 6 -10 measured the attitude which students exhibit towards the learning of mathematics when taught by teachers using democratic/facilitative classroom leadership style while items 11-15 measured the attitude which students exhibit towards the learning of mathematics when taught by teachers using permissive/laissez faire classroom leadership style. Both TCLSQ and SAMLQ were rated on a four-point Likert-scale of Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2), and Strongly Disagree (SD = 1).

Validation and Reliability of Instrument

TCLSQ and SAMLQ were validated by three mathematics educators and two experts in guidance and counseling. These two instruments were administered to thirty students who did not participate in the main study. A reliability coefficient of 0.72 and 0.78 were established for TCLSQ and SAMLQ respectively, using the Cronbach alpha reliability method. The established reliability indices of both instruments showed that they are reliable to conduct the study.

Procedure for Data Collection

Permission was sought from the administrative heads of the sample schools before the commencement of data collection. The instruments were administered to the sample students by the researchers on a face to face mode with the help of four research assistants who were

briefed on the modality on the procedure involved in the successful administration of the instruments. The administered instruments were retrieved on the spot to avoid instrument damage. Out of the 720 instruments that were given out, the researchers were able to successfully retrieve 710 which were used for data analysis.

Method of Data Analysis

The linear regression analysis was used to test the null hypotheses at .05 significant level. The analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 21.

Results

Table 1: Summary of linear regression analysis on the relationship between teachers' classroom authoritative/autocratic leadership style and the attitude of students towards the learning of mathematics

a. Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.772 ^a	.495	.594	.24203

a. Predictors: (Constant), Authoritative/Autocratic

b. Coefficients^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.150	.082		13.971	.000
	Authoritative	.743	.028	.772	26.264	.000

a. Dependent Variable: Attitude

c. ANOVA^a						
Model		Sum of Squares	Df	Mean Square	F	p-value
1	Regression	40.409	1	40.409	538.217	.000 ^b
	Residual	27.474	709	.059		
	Total	67.884	710			

a. Dependent Variable: Attitude

b. Predictors: (Constant), Authoritative/Autocratic

The R-square value of .495 in Part A shows that the autocratic teachers' classroom leadership style contributed 49.5% to students' attitude towards the learning of mathematics. The regression equation $y = 1.150 + .743x$ shows that an increase in the autocratic teachers' classroom leadership style led to a corresponding increase in the attitude of students in mathematics. Part B of table 1 shows that the summary of linear regression analysis on the relationship between teachers' authoritative/autocratic classroom leadership style and students' attitude towards learning mathematics was strong and positive (beta=.772). The result of the F-statistic shows that there is a significant relationship between teachers' autocratic classroom leadership style and students' attitude towards the learning of mathematics (df=709, F=538.217, $p < .05$). H_{01} was therefore rejected at 0.05 significant level.

Table 2: Summary of linear regression analysis on the relationship between Teachers' classroom democratic/facilitative leadership style and the attitude of students towards the learning of mathematics

a. Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.803 ^a	.644	.643	.22695	

a. Predictors: (Constant), Democratic/Facilitative

b. Coefficients^a					
Model		Unstandardized Coefficients		Standardized T Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	.796	.086	9.228	.000
	Democratic	.738	.025	.803	.000

a. Dependent Variable: Attitude

c. ANOVA^a						
Model		Sum of Squares	Df	Mean Square	F	p-value
1	Regression	43.727	1	43.727	848.935	.000 ^b
	Residual	24.157	709	.052		
	Total	67.884	710			

a. Dependent Variable: Attitude
b. Predictors: (Constant), Democratic/Facilitative

The R-square value of .644 in Part A shows that the democratic teachers' classroom leadership style contributed 64.4% to students' attitude towards the learning of mathematics. The regression equation $y = .796 + .738x$ shows that an increase in the democratic teachers' classroom leadership style led to a corresponding increase in the attitude of students towards the learning of mathematics. Part B of table 2 shows that the summary of linear regression analysis on the relationship between teachers' classroom democratic/facilitative leadership style and the attitude of students towards the learning of mathematics was very strong and positive (beta=.803). The result of the F-statistic shows that there is a highly significant relationship between teachers' democratic classroom leadership style and students' attitude towards the learning of mathematics (df= 709, F=848.935, $p < .05$). H_0 was therefore rejected at .05 significant level.

Table 3: Summary of linear regression analysis on the relationship between teachers' classroom permissive/laissez faire leadership style and the attitude of students towards the learning of mathematics

a. Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.127 ^a	.058	.014	.37738	

a. Predictors: (Constant), Permissive

b. Coefficients^a					
Model		Unstandardized Coefficients		Standardized T Coefficients	Sig.

		B	Std. Error	Beta		
1	(Constant)	2.928	.133		21.990	.000
	Permissive	-.113	.041	-.127	2.765	.006

a. Dependent Variable: Attitude

c. ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	p-value
1	Regression	1.089	1	1.089	7.646	.006 ^b
	Residual	66.795	709	.142		
	Total	67.884	710			

a. Dependent Variable: Attitude

b. Predictors: (Constant), Laissez Faire/Permissive

The R-square value .058 in Part A shows that the permissive teachers' classroom leadership style contributed 5.8% to students' attitude towards the learning of mathematics. The regression equation $y = 2.928 - .113x$ shows that an increase in the permissive teachers' classroom leadership style led to a corresponding decrease in the attitude of students towards the learning of mathematics. Part B of table 3 shows that the summary of linear regression analysis on the relationship between teacher classroom permissive/laissez -faire leadership style and the attitude of students towards the learning of mathematics was weak and negative (beta= -.127). The result of the F-statistic shows that there is a significant negative relationship between teacher permissive classroom leadership style and students' attitude towards the learning of mathematics (df=709, F=7.646, $p < .05$). H_{03} was therefore rejected at 0.05 significant level.

Discussion of Findings

The first finding of this study revealed that there exist a strong and positive relationship between teachers' authoritative/autocratic classroom leadership style and students' attitude towards the learning mathematics in Rivers State senior secondary school. This implies that the authoritative classroom leadership style which teachers employ to deliver mathematics instruction in senior secondary schools has an impact on the attitude of students towards successful learning of mathematics. The finding revealed that the use of authoritative leadership style by teachers to teach mathematics made a 49.5% contribution to the attitude of students towards learning of mathematics. When students are taught mathematics in a classroom leadership atmosphere which is authoritative, it infuses tension in the students and makes them to be withdrawn. The withdrawal is as a result of fear of been hushed or punished by the teacher. This classroom leadership style when increased also leads to an increase in the negative attitude of students towards the learning of mathematics. However, the increase is significant and could be attributed to the mathematical knowledge which students already possess before participating in the classroom instruction. This finding is not in agreement with the research findings of Isaac (2011) and of Mazana, Montero and Casmir (2019) which revealed no significant relationship between teachers' leadership styles and students' performance in mathematics.

The second finding revealed in table 2 showed that there exist a very strong and positive relationship between teachers' democratic/facilitative classroom leadership style and students' attitude towards the learning mathematics in Rivers State senior secondary schools. This implies that the democratic classroom leadership style which teachers employ to deliver

mathematics instruction in senior secondary schools has an impact on the attitude of students towards successful learning of mathematics. The finding revealed that the use of democratic leadership style by teachers to teach mathematics made a 64.4% contribution to the attitude of students towards learning of mathematics. When students are taught mathematics in a classroom leadership atmosphere which is democratic, it provides a physically and emotional safe environment for the students to learn. This safety promotes their attitude towards the learning of mathematics. Students feel free to ask questions to clarify their doubts concerning what they learn. An increase in democratic classroom leadership style also leads to an increase in the positive attitude of students towards the learning of mathematics. It is important to note that this increase is significant and could be attributed greater classroom participation of both teacher and students during the classroom instruction. This is in conformity with findings of Gyasi, Xi and Owusu-Ampomah (2016), Amalu and Njoku (2018), and Nsubuga (2008) which revealed that democratic leadership style has a strong and positive relationship with staff and students' performance.

The third finding of this study revealed that there exist a weak and negative relationship between teachers' permissive/laissez fairer classroom leadership style and students' attitude towards the learning mathematics in Rivers State senior secondary schools. This implies that the permissive classroom leadership style which teachers employ to deliver mathematics instruction in senior secondary schools has a weak impact on the attitude of students towards successful learning of mathematics. The finding revealed that the use of permissive leadership style by teachers to teach mathematics made just 5.8% contribution to the attitude of students towards learning of mathematics. When students are taught mathematics in a classroom leadership atmosphere which is permissive, it sets the classroom atmosphere in out of control mode. It liberates the students into been in charge of most of the activities that take place during classroom instruction. Most times students taught mathematics under a laissez faire classroom leadership gets out of control by disorganizing the classroom instruction. This classroom leadership style when increased leads to a decrease in the positive attitude of students towards the learning of mathematics.

Conclusion

This study concluded that the classroom leadership style which mathematics teachers employ to teach mathematics has a significant relationship with students' attitude towards the learning of mathematics in senior secondary schools In Rivers State. The facilitative/democratic teachers' classroom leadership style was revealed to have a more strong and positive relationship with students' attitude towards the learning of mathematics than the authoritative/autocratic and permissive /laissez faire leadership styles.

Recommendations

Based on the findings of this study, the researchers recommended that mathematics teachers in Rivers State senior secondary schools should endeavour to put into practice the democratic/facilitative classroom leadership style during mathematics instruction in order to improve the positive attitude of students towards the learning of the subject. However, the teachers should be cautious of derailing from the democratic leadership style in order not to elicit undue liberty from students in classroom interaction.

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DIGITAL AFFORDANCES IN INDUSTRY 4.0 ERA: TOWARDS THE CREATION OF SUSTAINABLE LEARNING ENVIRONMENTS

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Abstract

This paper developed a mobile app in response to industry 4.0 developments, to transform a rural university into a smart town that promotes sustainable learning environments. This was necessitated by the rapidly growing need to ensure efficiency at a rural university, to improve the university's interactive engagement with students, and to transform a rural university into a smart town. This study focused on digital affordances that promote student engagement aspects related to campus and class engagement. In doing so, we noted that some countries have embraced industry 4.0 and have automated their industrial processes by integrating virtual and physical systems, while Zimbabwe seems to be lagging. Government and funding organisations for higher education institutions have expressed interest in clear strategies to encompass student engagement in their policies and activities. The study employed design science research methodology (DSRM) whose philosophical orientation is pragmatism with 80 participants drawn from students at Lupane State University. The results of this study revealed that participants indicated that the developed app was usable and was easy to learn to use with no or with limited assistance, ultimately promoting a sustainable learning environment.

Keywords: *Design Science Research; Industry 4.0; Internet of Things; Sustainable Learning Environments, Technology Acceptable Model.*

Introduction

In many countries, industry 4.0 is fast becoming the core of manufacturing firms, and artificial intelligence, Internet of Things (IoT) and big data are driving manufacturing processes with ever-higher productivity and improved profitability (Okano, 2017). Industries have evolved and transformed to meet consumer needs through the use of robots and artificial intelligence, to create smart objects and machines that are responsive (Fonseca, 2018; Vasin, Gamidullaeva, Shkarupeta, Palatkin, & Vasina, 2018). Industry 4.0 promotes the establishment of intelligent smart systems that possess advanced functionalities that can support new consumer products through utilising IoT and data analytics (Schumann, Baum, Forkel, Otto, & Reuther, 2017). This innovation has also spilt into the field of education, as a means to ensure sustainable learning environments.

Whilst universities in developed countries are making meaningful contributions through innovative inventions, universities in developing countries like Zimbabwe have little technological innovations to offer (Maphosa, Dube & Jita, 2020). One way developing nations could catch-up with developed ones is to promote digitalisation of the marginalised communities. In response to industry 4.0 requirements and the promotion of sustainable environments, mobile apps offer a convenient starting point for creating a virtual and physical environment. To this end, the Zimbabwean education landscape has been called upon to transform, acquire skills and prepare students for the lived realities of industry 4.0.

As part of living to the realities of 4.0, the Ministry of Higher Education emphasised the need for universities to apply digital technologies, such as IoT, big data, robotics and knowledge automation, to produce graduates who are critical thinkers and possess a technology-oriented mindset (Jonathan, 2019). With the implementation of 4.0 local universities were encouraged

to establish innovation hubs that could help Zimbabwe industrialise and produce products that would enhance the competitiveness and employability of graduates. The university is a critical and relevant site to tease and configure thinking towards appreciation of emerging technologies, such as robotics, IoT, artificial intelligence and other innovations, to ensure sustainable education. The university, in the context of 4.0, is moving towards the establishment of cyber-physical systems. This will be done through the integration of systems to create knowledge, by linking people, software systems and objects for value addition, and to improve production and communication (Posada et al., 2015) as means of creating smart towns for proper education, especially in rural contexts. While the idea is noble and desirable, some Zimbabwean universities like Lupane State still do not have digital devices and proper connectivity to support learning in the era of 4.0. Thus, the research developed and evaluated a mobile app to mitigate and a surrogate while other alternatives of being sought to address the challenges.

The integration of mobile internet has provided the impetus to create smart towns in a rural context, which has improved the management of resources, promoted environmental sustainability and citizen engagement. Harrison and Donnelly (2011) noted that developing countries should apply broad-based socio-technological innovations that promote good governance and provide convenience to residents. Lupane State University, which is located in Lupane rural district council in Zimbabwe, has started to move to integrate information and communications technology (ICT) to improve the management of various services. The ultimate aim is to create a smart town in a rural context, expand digital affordances, to improve the lives of students and, consequently, promoting sustainable learning environments. Universities have acknowledged the role of student engagement in improving students' learning experience and have set up policies and practices to foster engagement (Baron & Corbin, 2012). Some researchers have examined several aspects relating to student engagement, such as emotional and behavioural aspects, psychological and social engagement, together with campus and class engagement (Hausmann, Schofield & Woods, 2007; Matthews, Andrews & Adams, 2011). The commonwealth policy on higher education funding requires evidence from institutions, involving simple steps and attempts to enhance student engagement (Leach, 2016).

Industry 4.0 has resulted in the emergence of smart factories connected using Cyber-physical systems (Lee, 2014). Industry 4.0 is driven by mobile computing, big data, cloud computing, distributed ledger systems, augmented reality, additive manufacturing and autonomous vehicles, among others (Passow & Passow, 2017). Internet of things, it refers to the billions of physical devices around the world that are now connected to the internet, all collecting and sharing data (Ranger, 2020). Thus, Lupane State University seeks to create a smart town by integrating the physical infrastructure with IoT devices to collect data in real-time. Smart town services include automated monitoring of garbage, water levels, and traffic, and access to information and related to services, which are at the core of industry 4.0 (Elmustafa & Zeinab, 2017). Sustainable learning environments (SULE) – a concept coined by Sechaba Mahlomaholo, and defined as a space that affords all learners, all teachers, all members of the parent community and the whole of civil society equal opportunities to live, to work, to learn and to be innovative among others, in the absence of oppression and marginalisation, but in freedom, peace and harmony with one another (Mahlomaholo, 2012). Also, sustainable learning environments are conditions of learning that enables all learners to explore and exploit their potentialities to the fullest so that they can become contributing members of a democracy (Mahlomaholo, Nkoane & Ambrosio, 2013). Cognisant of this definition, SULE is used in this paper to refer to a set of conditions such as the use of apps to assist rural

university students in maximising their academic potential in the face of multi-depravity. As used in this paper, it refers to the engagement which students make through the mobile app to create sustainable learning environments as a starting point towards achieving the goals of 4.0 industry in a rural university like Lupane State University. The following section addresses the theoretical framework.

Theoretical Framework: The Technology Acceptable Model

The technology acceptance model (TAM), developed by Davis (1989), provided the theoretical grounding for the study. The model was used to evaluate the app's perceived usefulness, ease of use and the overall intention of using the app. King and He (2006) conducted a critical literature review on 88 published articles, and they established that TAM was a robust and reliable model for evaluating a learning application. Alenezi et al. (2011), concluded that TAM had been proved to be reliable in predicting technology adoption. Other researchers who investigated the use and acceptance of a broad range of end-user computing technologies utilised the TAM (Venkatesh, Morris, Davis & Davis, 2003).

Most of the research on TAM has focused on developed countries, and there is a need to conduct more studies in developing countries to understand and verify its cultural validity (Teo, 2013). The two essential constructs of the TAM are the perceived usefulness and perceived ease of use, which determine the attitude of a user towards a particular system (Venkatesh et al., 2003). Perceived usefulness and perceived ease of use have positive influences on the attitudes, behavioural intentions to use the system, and usage. Perceived usefulness is the degree to which using the My Lupane State University application (MyLSU App) would improve student engagement and promote the concept of a smart town. Perceived usefulness is driven by how easy students will rate the app to be of use in enhancing access to university resources, simple, easy to use, and would use it without seeking assistance. Thus, the theory is relevant as it promotes technology acceptance at the rural institution in a multi-depraved context, where there are limited resources to support effective learning. Resource deprived communities can easily engage in activities that help them leap into the industry 4.0 space. In the following section, the paper reviews related literature.

Review of related literature

In response to industry 4.0, and in response to a need for smart towns and the need to create sustainable learning environments for rural university students, a mobile app was developed by the research that enables the university students to engage holistically with its students' lives on campus. This research relates to various studies on the use of technology for teaching and learning. For example, in Zimbabwe, a study was conducted by Tunjera, Mukabeta, Ramirez and Zinyeka (2014), who investigated how mobile apps could be used to address constraints associated with limited access to learning resources, collaboration and interaction between lecturers and students. The study found that Mobile learning afforded self-expression and self-reflection as the distance students' documented experience, published thoughts on the mobile application. Maketo (2018) conducted a study on using mobile phones to support collaboration between learners and to provide access to content, which increased subject comprehension. Blair (2012) argues that twenty-first-century skills are acquired when students continuously use technology in the classroom to gain vital skills that will be expected of them in the future when they join the workforce. Scholars note that students value accessibility, immediacy and efficient access to personalised information that facilitates interaction amongst the students (Gardner & Davis, 2014). Using mobile apps allows students to work independently (Caballéa, Xhafab & Barollic, 2010). It changes the teaching and

learning approach from the traditional teacher-centred paradigm to a student-centred and friendly environment that promotes creativity, critical thinking and the development of new knowledge and skills (Dias & Victor, 2017). While these studies are valuable, very few focused on rural contexts, such as that of Lupane State University, or the need to create sustainable learning environments and smart towns.

Thus, the study developed and evaluated a mobile application that enables rural-based university students to access industry 4.0 services, such as the use of digital technologies for learning. The study is novel in the sense that it developed and evaluated a mobile app for learning, which complements online classrooms and social media (Harvard Mobile, 2017). To achieve this, students use laptops and log into the university system. However, this research was informed by the need to usher in sustainable learning environments by creating a smart university town, and in response to 4.0. The mobile apps offered a more effective and responsive way of reducing time delays in decision-making and greater convenience, which is an objective of industry 4.0. The app also offered the opportunity to support the deployment and adoption of IoT, to enable students to communicate with each other and make decisions that promote sustainable learning environments (Fonseca, 2018).

Materials and Methods

This study employed the design science research methodology (DSRM), whose philosophical orientation is pragmatism (Hevner & Chatterjee, 2010). Pragmatism attempts to answer research questions by bridging science and practical action, which results in the creation of an artefact that solves real-world problems. The design science approach, as posited by Saunders et al. (2009), aims to develop useful knowledge that solves business and societal problems through the use of tools or concepts. The DSRM aligns well with pragmatism as it attempts to develop artefacts which attempt to address existing societal problems, the artefacts can take the form of an instantiation, model or design theory (Vaishnavi & Kuechler, 2015). DSRM has been viewed as an intermediary between theory and practice within the Information System community (Goldkuhl & Sjöström, 2018), which uses quantitative methods. In this study, an artefact was designed to promote industry 4.0 through improved student engagement at the university and to promote a sustainable learning environment. The processes followed by this methodology increases the usability of the system, through focusing on attitudes and behaviours related to the user's task, rather than on that of the developers; consequently, users do not have to adapt to the system (Kotamraju & van der Geest, 2012). Researchers conclude that, when potential users are involved throughout the stages of the development process, it is easier to establish and eliminate, an earlier stage, mistakes that could impact usability and functionality at a later stage. The result is the creation of high-quality products that meet the expectations of users (Bias & Mayhew, 2005; Kotamraju & van der Geest, 2012). A three-cycle DSRM adapted from Hevner (2007) guided the development of the artefact. Figure 1 shows the three cycles: the relevance, design and the rigour cycle.

Relevance cycle

A problem is a gap between the current state and the desired state, while problem relevance is defined as the extent to which an artefact solves a particular problem (Grant, 2016). The relevance cycle provides an overview of the domain, research problem and links it with environment or community which the proposed artefact has to serve. It must be clear what problems the intervention aims to solve and show the various alternatives that could solve the problem. There is a need to ensure that rural institutions have access to technologies that ensure efficiency and improve the university's interactive engagement with students, and to

transform a rural university into a smart university town. We designed and evaluated a mobile app that transformed a rural university and allowed it to experience some of the industry 4.0 concepts.

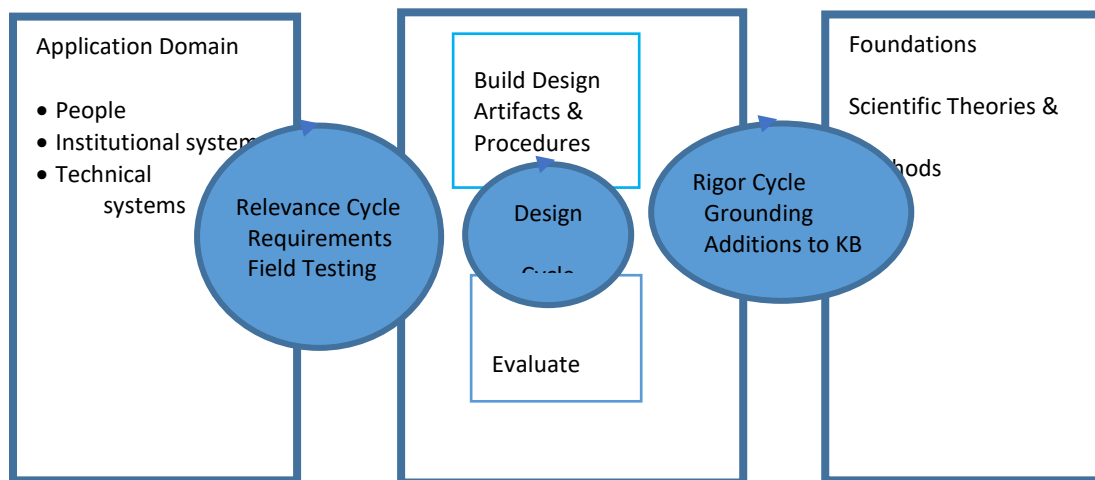


Figure 1: Three cycle Design Science Research methodology, Hevner and Chatterjee (2010)

Design cycle

In this phase, the user specifications are converted into a usable artefact. The design is converted into a product that meets the user's requirements and the constraints of a problem being solved. Hevner et al. (2004) posited that a complete and useful artefact must meet the requirements of the user and the constraints of a problem being solved. When designing an artefact, prototypes are used. The fidelity of the prototype is the extent to which the functions of the prototype resembles the final product (Nielsen Norman Group, 2016). We used low fidelity prototypes in the initial designs through the use of paper-based sketches and presented them to potential users. The use of prototypes helped us in finalising the app requirements. The low fidelity prototypes were transformed into high fidelity prototypes which provided some functionality such as user interfaces and navigation links. Feedback was sought from potential users and was incorporated into the design to improve the functionality of the app.

The front-end was developed using Android studio. The app's front-end provides an interface for the user to view data and also enter data to interact with the app. RESTful web services/API facilitates the interaction between the front-end and the backend through accepting HTTP requests and responding using JSON (JavaScript Object Notation). The app's business logic and interaction with the database are executed by the backend API, which handles all HTTP requests. The essential services performed include adding, editing, or getting the necessary data. The app will be database driven, and MySQL was chosen while the Apache webserver will run our custom web services. We tested the app to verify that it worked as intended and to eliminate any bugs or errors before deploying it.



Figure 2: MyLSU app

The system's use case is shown in figure 2, depicting how the student interacts with the app. We adopted a scrollable two-dimensional grid menu, as shown in figure 3 (Android Developers, 2017). The use cases helped in defining the system's boundaries. The system allows the student to access services such as transport timetables, notifications, academic records, voting, financial records and campus entertainment updates, as shown 4. The app is linked to the university's systems for accessing pertinent information. To access the app, the student should download through a link on the university's website. Once the app has been installed, the students are required to use their login credentials to access services and information.

The sample

A total of 80 students based at the Lupane State University in Zimbabwe were randomly selected to participate in this study by downloading the app on their phones. The students were asked to evaluate the app through an online questionnaire that was embedded in the app. The app evaluation was based on TAM. The self-administered questionnaire included questions that related to ownership of other ICTs; demographic, perceived usefulness and perceived ease of use data was also collected. The instrument used a 5-point Likert scale, where 1 represented Strongly Disagree, and 5 Strongly Agree. George and Mallery (2003) set 0.7 as minimum Cronbach alpha value for the validity and reliability of the instrument. Our study observed a Cronbach alpha value of 0.79 across all the constructs. Participants chose an appropriate level of agreement in evaluating the mobile app for promoting student engagement and smart towns. Quantitative data collected through the questionnaire were analysed using SPSS version 21 software to compute descriptive statistics, means and standard deviation. A total of 80 students completed the questionnaire, giving a response rate of 100%.

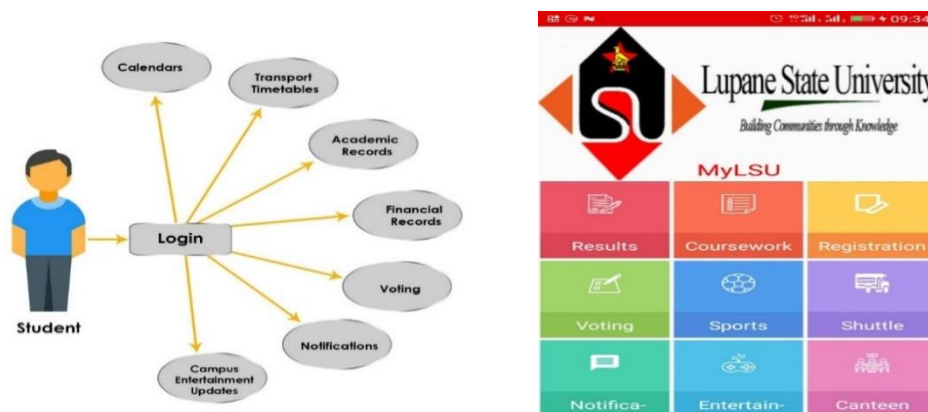


Figure 3: Student interacting with MyLSU app

Ethical clearance

The University of the Free State granted ethical clearance, and the ethic certificate number is UFS-HSD2017/0998 to conduct this research. Participants were presented with a consent form, which explained that participation was voluntary and anonymous (Shallwani & Mohammed, 2007), and that participants had the right to withdraw if they no longer wished to participate. Students who participated were assured that information that was gathered would be used for academic purposes and would be kept confidential (Babbie & Mouton, 2001). The identities of the respondents remained anonymous, and their responses were used for the production of this article only, while the data generated was kept private.

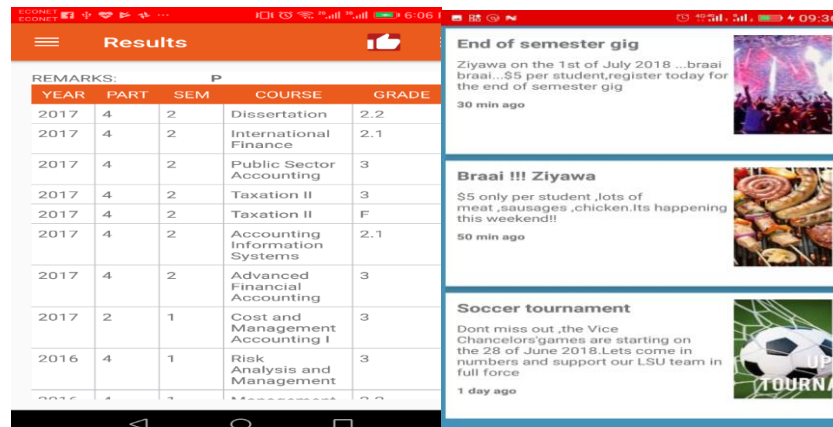


Figure 4: Screenshots of academic results and entertainment information

Mobile app evaluation

Following the DSRM, and the TAM, the app was evaluated through experimentation with real users. The main aim was to expand digital affordances and promote a smart university town by developing an app that enhances access to services and information at a rural university. Several evaluations were done to assess the utility of the app, verify if its content was useful and also the general design and layout of the app. Some of the elements being tested were adapted from Harrison et al. (2013) measuring the usability of an application with attributes such as usefulness, satisfaction and learnability.

Findings and discussion

Female participants constituted 60%, while 40% were male. About 69.1% of the participants were undergraduate while 30.9% were postgraduate. The age distribution was as follows, 38% were between 18 – 24 years old, 37.6% were between 25 – 30 years, and 24.4% were over 30 years. All the students owned a mobile device or had access to one. All the students had several apps installed on their phones. In a similar study in South Africa, Ruxwana and Msibi (2018) observed that 88% of the students owned a mobile phone and with some owning more than one. High mobile phone ownership presents an excellent opportunity for universities in rural contexts to embrace mobile app and promote smart-university towns. This can enhance steps towards achieving industry 4.0 in a resource-deprived environment and ensure sustainable learning. About 78.8% of the students agreed that the app was functional while 22.2% disagreed. Thus, the app can be used to strengthen the student's affinity with the university, thereby promoting sustainable learning environments in a rural context.

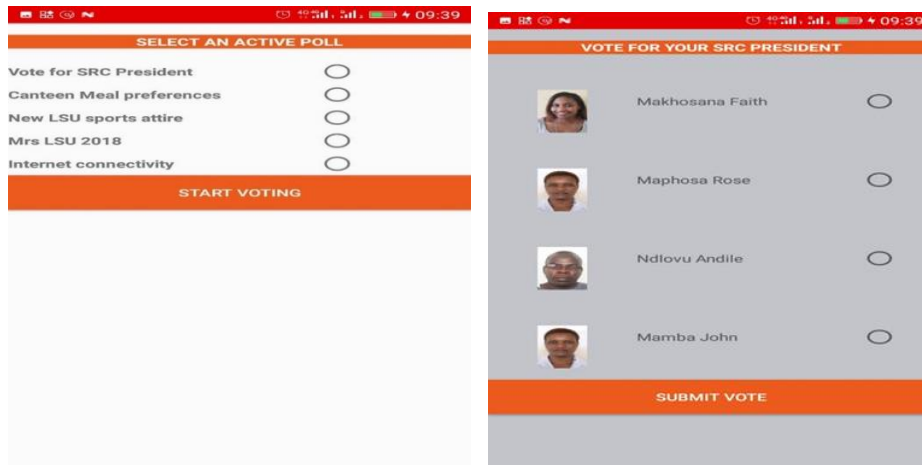


Figure 5: Screens for voting for the SRC president

Regarding the design of the app, 75% of the students agreed that the app was pleasant, while 12.5% disagreed and the remainder were neutral. The results are comparable to that of the ACE app, whose evaluation showed that 83% of the participants agreed that it was designed well (Seow & Wong, 2016). About 76.3% of the participants agreed that they would recommend the app to their colleagues. This finding is similar to work by Seow and Wong (2016), who found out that 85% of participants were willing to recommend the app to others. The results indicate that despite the institution being located in a rural and remote environment; it could leverage on the deployment of such apps to transform the community into a smart university town. The app can also extend some services to the community.

Regarding simplicity, 70% of the participants agreed that the app was simple, while 10% chose neutral and 20% chose disagreed. This observation resonates with work by Jonas-Dwyer, Clark, Celenza, and Siddiqui (2012), who posit that an app must be simple and easy to use, with straightforward navigation and menus. This finding is essential in the sense that some of the students experience the use of technology at the university level; thus, it is critical that mobile apps for learning become friendly and also aid access to information and services.

Table 1: App evaluation response rates

Response options	App is functional	The app is designed well	App is simple	The app is easy to learn	Will recommend app
Strongly disagree	12	0	0	0	0
Disagree	5	10	16	12	19
Neutral	0	4	8	10	0
Agree	16	16	18	20	26
Strongly agree	47	50	38	38	35
Total	80	80	80	80	80

The majority (72.5%) of the participants revealed that the app was easy to learn to use, and they would not require any assistance to use it, while 15% disagreed and 12.5 were neutral. This finding echoes that of Jonas-Dwyer et al. (2012) who found that 75% of the

participants considered the app to be easy to learn. The value of the standard deviation that was observed was low, ranging from 0.22361 to 0.50262, as shown in Table 2. Thus, responses are close to their central tendency.

Table 2: Standard deviation and mean for MyLSU app

		Design appealing	App is Simple	Highly functional	Easy to learn	Would recommend
N	Valid	80	80	80	80	80
	Missing	2	0	0	0	1
	Mean	4.6500	4.9500	4.4000	4.6500	4.9000
	Std. Deviation	.49	.22	.50	.49	.31

The MyLSU mobile app allowed students to access resources that improved their lives on campus by improving access to information from anywhere and at any time. Access to this information enhanced their engagement with the university, thereby promoting the concept of a smart town. It is through the access of information that sustainable learning conditions can be achieved, not only for purposes of moving towards industry 4.0 but as an act of social justice, hope, and democracy for university students in rural learning contexts such as Lupane State University.

Limitations

The sample that we used to evaluate the app was relatively small, which makes it difficult to generalise the results. We targeted the Android market, which controls over 80% of the global operating system market – almost 100% in developing countries. The app should also be developed for the iOS market (Gartner, 2016).

Recommendations

The app was only used for information aggregation. Future improvements could see the integration with more Internet of Things (IoT) devices, such as radio-frequency identification (RFID) tagged devices. The integration will help the university to smartly monitor services, such as electricity usage, litter, water levels and pollution, amongst other essential contributors to industry 4.0. The study also recommends that institutions of higher learning, especially in rural contexts, should invest more in purchasing devices and software that can complement mobile app as the move towards creating sustainable learning conditions and meeting the goals of 4.0 industry. Such as act, will also ensure that rural students experience justice, access to technology, and conducive learning environments as an act of democracy.

Conclusion

In this paper, we discussed the mobile app that we developed to expand digital affordances in light of industry 4.0 developments, smart towns and a need for sustainable learning environments. Through this research, the app we developed presents a significant leap in attaining the goal of industry 4.0, which requires improved access to information and services which promote a smart university town. Improved student engagement also promotes some tenets of 4.0. The paper argued that sustainable learning environments could only be achieved when educators embrace the use of technology in teaching and learning, especially in contexts that are rural, such as the case with Lupane State University in Zimbabwe. This paper argues that the technological barriers related to accessing industry 4.0 services, can be mitigated by adopting the mobile app, MyLSU can go a long way to promote smart services and digital technologies that anchor sustainable learning environments. Thus, transforming university campuses into emerging smart towns.

Evaluation results showed that the students perceived that MyLSU app was useful and easy to use. The mobile app enabled students to access resources that improved their lives on campus by improving access to information from anywhere and at any time. The results of the study do not only show technology adoption at a resource deprived environment but also highlights how simple technologies could be harnessed to enable communities to experience some industry 4.0 services. The results should appeal to policymakers, government and researchers to use these findings for the deployment of technological solutions in rural communities. We highlighted the limitations of this app and proposed how these could be addressed in the future. This article serves as a space for other researchers to problematise this study, to improve the app and promote sustainable learning environments and smart towns further.

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FACTORS THAT AFFECT THE PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN ORAL ENGLISH IN ABUJA MUNICIPAL AREA COUNCIL, FCT-NIGERIA

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Abstract

The study examined the factors that affect the performance of senior secondary school students in oral English in Abuja municipal area council, Federal Capital Territory (FCT). It looked at the role English Language plays in Nigeria as a lingua franca and as a medium of instruction. The principle of the Behaviourist Theory of Language acquisition was adopted for the study. The research design used was descriptive survey design. The population of the study comprised all the senior secondary school students in Abuja Municipal Area Council. One hundred and twenty-one (121) students from five government senior secondary schools in Abuja Municipal Area Council were selected as the sample for the study. The data for the study were gathered through a questionnaire and a test for Oral English Proficiency (QOEP). In order to ascertain the validity of the instrument, face and content validities were adopted. The questionnaire was pilot-tested and reliability coefficient of 0.7 was obtained using Cronbach alpha method. The findings showed that some teachers teaching English Language were not proficient in teaching orals in senior secondary schools. Also, there were no enough English language teachers and facility for language laboratory. It was recommended among others that, the stakeholders in the government should ensure that proficient graduate teachers are made to teach English language in secondary schools.

Keywords: English, Oral Performance, Senior Secondary Schools.

Introduction

The ability to speak and write English correctly is the most useful skill which any person in the English-speaking world should strive to attain. English remains the indisputable language of governance, administration, legislation, judiciary, international relations and language of unification in Nigeria (Federal Government of Nigeria, 2004). As a second language, most Nigerians face major problems in speaking and writing English language like the native speakers (Oribabor, 2014). Speech involves language sounds which are associated with meanings. Knowledge of a language, therefore, presupposes knowledge of the speech sounds of the language. The goal of English Language teaching is to offer learners the ability to use English effectively. Thus, the study examined the factors that affect the performance of senior secondary school students in oral English in Abuja municipal area council, FCT.

Statement of the Problem

The spoken English is the second of four language skills. Akindele (2015) opines that it is a vital component on which other areas of the English grammar, reading and writing is based. Considering the role English Language plays in Nigeria and the fact that the language has been in existence for over a century, learners perform poorly in school certificate examinations especially in oral English (Ilupeju, 2014). Abuja, the Federal Capital Territory is a cosmopolitan city, which houses Nigerians from different ethnic groups. The language of the environment is English. It is expected that learners in senior secondary schools should have oral proficiency in the language. The problem is more alarming when one considers the percentage of learners who fail the English Language at the Senior Secondary Certificate Examination. Jowith (1991) confirms that the emphasis on proficiency in spoken English was

introduced in the new national curriculum in English Language for Nigerian secondary schools in the 1980s. It was previously neglected in the teaching of English in Nigeria as oral English was made optional for West African School Certificate students (though a compulsory course for teachers' grade II examination in those days). Roach (2000) opines that pronunciation teaching has not always been popular with teachers and language theorists in the 1970s and 1980s.

The teaching of oral was neglected because it was claimed that it makes learners sound like native speakers of Received Pronunciation, which became difficult and led to repetition of exercises, and that it also failed to give importance to communication. Jowith (1991) further comments on the negligence of oral English teaching on teachers. He stated that learners unconsciously relied on mother tongue models when they are deprived of consistent and reliable guidance from teachers. Thus, the study examined the factors responsible for senior secondary school students' poor performance in oral English in Abuja municipal area council, FCT.

Concept of Listening and Speaking Skills

Listening and speaking are the first two skills the learner of English must learn. They are the initial skills acquired in any language. Success in society depends on the cultivation of the skills of listening and speaking. Ilupeju (2014) opines that listening is a skill which must be cultivated. It is not only the perception of sounds but also the ability to understand and evaluate what one hears. Most often one hears a speaker very clearly but do not listen to what he is saying for some obvious reasons. For instance, our minds might be on some previous engagement or we are not interested in what the speaker is saying. A good learner must strive to listen with concentration in order to retrieve information and evaluate it.

Ofuya (1996) identifies some factors which could inhibit perfecting the spoken English. These are personal attitude, writing and pronunciation in English and mother tongue inference. Some individuals regard the ability to speak English intelligibly as unnecessary compared with reading and writing English. This is seen in the fact that spoken English is not given the same status as written English in the school certificate examination or GCE ordinary level. This results to why many Nigerian speakers of English resolve to sub-standard variety of spoken English.

Empirical Review

There is a dearth of empirical research on factors that affect performance of students in oral English in Abuja Municipal Area Council, but the study reviewed relevant studies on factors that affect performance of students in oral English. In the study carried out by Soomro & Farooq (2018) it was discovered that lack of measures on the part of teachers and learners as well as the classroom setting do not fully facilitate both the male and female students to learn speaking skill in a better way. The poor level of their skill in English is attributed to the variety of teachers', learners', and environment related factors. Jack (2012) identified poor quality teaching and materials in teaching speaking skill. This study is on factors responsible for poor performance in oral English in Abuja Municipal Area Council. Therefore, it will bridge the gap in literature in oral proficiency.

Pronunciation and writing could be a factor that deters success in oral English. In the second language situation as Nigeria, the educated users of English are usually exposed to a much greater volume of standardized written English than they are to standard spoken English. Juxtaposed with written English in Nigeria are the written forms of the indigenous languages

which are almost completely phonetic because there is almost always a one-to-one correspondence between sound and letter in the written forms of Nigerian Languages (Adegbija & Ofuya, 1996).

However, writing when compared with speaking is more static. Writing changes gradually while speech is less permanent. In second language situations, there is the tendency to rely on spellings in pronouncing words just as an individual does when reading his/her mother tongue. Therefore, our spoken English is always full of errors, for instance, the following are description of differences between spellings and pronunciation in English. In written English, there are many spellings for one sound as with /i:/ which is spelt ie in believe, it is spelt oe in the first syllable in oesophagus and e in me, complete and theme.

The short vowel /I/ is spelt 'i' in fish /fɪʃ/ it is spelt e in the last vowel of gasket /gaskIt/ and in the first syllable of electronics. Some letters in written English are not pronounced at all in spoken English. For instance, b is not pronounced in comb, bomb, and lamb. P is not pronounced in receipt. You pronounce 'f' in physics, photo, it is absent in psalms, pneumonia, psychosis etc. There are also words that have the same pronunciation (homophones) but different spellings and different meanings as in ring/wring, cite/sight, site. Also 'homographs' this are words with same spellings, same pronunciation but different meanings). E.g. Sow/səʊ/ is to sow seed and sow /səʊ/, a full-grown female pig.

The implication of these inconsistencies in relation to pronunciation in English is that as second language speakers of English, learners and teachers alike must not rely on spellings or written forms for the correct pronunciation of words in English. English language is rule governed and learners must learn to use a correct model for instance, a pronouncing dictionary to be able to pronounce correctly, the English words so as to have proficiency both in spoken and written English (Ilupeju, 2014; Ofuya, 1996).

Mother Tongue interference is another factor which could cause poor performance of learners in oral English. Thyab (2016) views mother tongue as one's native language or parent language. The rules in his/her mother tongue naturally interfere with the rules of the English Language he is learning. These rules are always very different at all levels of language components, such as phonological, lexical and semantics. Mother tongue interference problems exist at all levels of phonological analysis, sound segments of vowel and consonant sounds and suprasegmentally of stress, rhythm and intonation. According to Ofuya (1996) the errors which derive from mother tongue interference are grouped into five types, over-differentiation of sounds, under-differentiation of sounds, re-interpretation of sounds, actual sound substitution and hypercorrection.

Over-differentiation happens when distinctions made in a Nigerian Language, but which are not in the English Language, but which are not in the English language are forced on the English Language. For instance, Hausas often say 'kwancurrent' for concurrent because /kw/ and /k/ are two different words in Hausa but they are not in English. Under-differentiation occurs when one sound in the mother tongue of a Nigerian is used for more than one sound in English. For example; most Nigerians use vowel sounds such as /i/ in their different mother tongues for /I/ and /i:/ in English.

Re-interpretation of sounds can occur when an individual misinterprets the English sounds he hears to sounds similar in his/her indigenous language. For instance, the English word 'inflamed' /Infleɪmd/ could be re-interpreted to mean 'efulefu' (Igbo) which means a

different thing and in different context. Actual sound substitution occurs when the English sounds which are not in Nigeria Languages are substituted for with those that are in them. For instance, most Nigerian Languages have no dental and inter-dental fricatives /θ/ and /ð/. Therefore, many Nigerians would say “dose tins” instead of ‘those things’ in Yoruba Language of Nigeria those with heavy mother tongue interference in English would replace all these sounds or some of these sounds /tʃ/, /v/, /θ/, /ð/, /z/, /ʒ/ with /Ss/, /f/, /t/, /d/, /s/, /ʃ/, /n/ respectively. Yoruba language does not have /h/ sound so, they say en for hen; eat for heat etc.

Hyper correction happens with many Nigerian speakers of English during the learning process. For example, individuals among the Yoruba people who have been taught to pronounce /tʃ/, /z/ etc. may say watch for wash and zeed for seed. Also, haxe for axe. Some may not get over this problem for a long time until it fossilized. All the problems of transfer of the mother tongue to the English language are caused by the differences in the phonological system of the English language when compared with those of the Nigerian Languages. The comparisons are based on English Received Pronunciation (RP) and a standard variety of the English Language in which Banjo (1971) tagged as variety three which is a closer accent to the native speakers and it has international intelligibility.

Another major factor which could be responsible for poor performance in oral English is the teacher who lacks the initiative to provide instructional material such as media and teaching resources which will facilitate the learning of oral English. Some teachers are not qualified to teach English in the secondary schools. Adedokun (2011) asserts that inadequate qualified teachers cause poor performance in English Language in the Senior Secondary Schools and those qualified exhibit poor abilities in oral and written expression. He added that with this kind of situation, teachers can never effectively have good performance from their products. Also, Ayodele (1988) cited in Babatunde (2003) laments on the low English Language competence of Nigerian students. He argues that the causes must be traced to classroom, some of these classroom factors are teachers’ low level of competence in the language skills.’

Theoretical Framework

The theoretical framework adopted for the study is the principles of the Behaviourist Theory. The Behaviourist theory of language acquisition states that language is a behaviour and consequently it is learned like any other behaviour via positive and negative reinforcement. The behaviourist theory believes that infants learn oral language from other human role models through a process involving imitation, rewards and practice. Human role models in an infant’s environment provide the stimuli and rewards (Cooter & Reutzler, 2004). When a child attempts oral language or imitates the sounds or speech patterns, he is usually praised and given affection for his efforts. Thus, praise and affection become the rewards. The same principle applies to the second language learning. The teacher is presented as a role model to the learner, through imitation of the sound patterns and with the use of instructional materials and practice. The teacher is expected to get a positive response from the learner. This study seeks to rely on the principles of the behaviourist theory to analyse the factors responsible for poor performance in oral English.

Purpose of the Study

Specifically, this study sought to achieve the following objectives:

1. Find out some of the factors that affect the performance of students in oral English among senior secondary school students?

2. Examine the extent of students' performance in oral English in Abuja Municipal Area Council FCT-Nigeria?
3. Determine the measures that will improve student' performance in oral English among senior secondary school students in Abuja Area Council?

Research questions

The following Research Questions were raised to guide the study:

1. What are some of the factors that affect the performance of students in oral English among Senior Secondary School Students?
2. What is the extent of students' performance in oral English in Abuja Municipal Area Council FCT-Nigeria?
3. What are the measures that will improve students' performance in oral English among senior secondary school students in Abuja Area Council?

Methodology

The research design of the study is descriptive survey research design. This design is suitable because it provides closed-ended questions. The population of the Study is the SSII Students' in Abuja Municipal Area Council (AMAC). Five schools were sampled from 21 Government-owned Day Secondary Schools using the Simple Random Sampling Technique. Out of a population of three hundred and three (303) respondents, 121 respondents (i.e. 40%) were selected.

The data for the study were gathered through a questionnaire and test of oral tagged "Questionnaire for oral English Proficiency (QOEP). The questionnaire comprised of 14 items and the oral test included 10. To ascertain the validity of the instrument, face and content validities were adopted. A colleague of the researcher in the department of measurement and evaluation unit helped in validating the instrument. It was pilot-tested with twenty students who were not part of the sample but in the population area. Cronbach's Alpha was used to test the reliability of the instrument. The Cronbach Alpha values were above 0.7 for all constructs indicating sufficient reliability.

Analysis of Results

The research question one posed for the factors responsible for low performance in oral English among Senior Secondary School Students in Abuja Municipal Council.

From the 121 questionnaires that were distributed, the following data was collected:

Table 2: Factors that affect the performance of Senior Secondary Students' in Oral

S/N	ITEMS	YES		NO	
		F	%	F	%
1	Inadequate English Language teachers in Senior Secondary Schools	85	70	36	30
2	Some teachers teaching English Language are not qualified	82	68	39	32
3	There is no facility for Language Laboratory	79	65	42	35
4	Teachers do not usually use instructional media in teaching Orals	85	70	36	30
5	Teachers do not use any material to aid the Oral Teaching	85	70	36	30
6	Students are not interested in the learning of Oral English	85	70	36	66
7	There is no measure to curb the speaking of Mother Tongue or Pidgin English in the School environment	81	67	40	33

English

From the above table, 70% of the respondents said yes to inadequate language teachers while 30% of them said 'no'. In item two, 68% of the students agreed that some teachers teaching English in Senior Secondary Schools are not qualified. Also, 65% of the respondents agreed that there is no facility for language laboratory while 35% disagreed with the statement. In item 4, 70% of the respondents said teachers do not usually use instructional media in teaching orals and also do not use any material to aid the oral English teaching while 30% said otherwise. 66% of the respondents said learners are interested in learning oral English while 34% of them said they are not interested in learning. In item 7, 67% of the respondents agreed that there has been measuring to curb the speaking of mother tongue or Pidgin English in the school environment. While 33% did not agree to it.

Table 2: Measures that could reduce Students' performance in Oral English

S/N	ITEMS	YES		NO	
		F	%	F	%
1	Qualified and proficient teachers should be made to teach Oral English	114	94	7	6
2	The School administrators could make English Language teachers embark on aspect teaching	108	89	13	11
3	There should be provision of a Language Laboratory	115	95	6	5
4	Instructional Resources such as Tape Recorder, Audio and Visual aids should be provided by the School Authority	109	90	12	10
5	Teachers should improvise teaching resources where there is no provision	109	90	12	10
6	Students should be motivated in the oral skill	116	96	5	4
7	Teachers and the School Authority should encourage intensive and extensive reading	109	90	12	10

In table two, out of 121 respondents, 94% agreed that qualified and proficient teachers should be made to teach English orals. Eighty-nine percent (89%) said the school administrators should make English language teachers embark on aspect teaching and Eleven percent (11%) disagreed to the statement. 95% of respondents agreed that there should be provision for a language laboratory in schools while five percent (5%) of them did not see the need for it. As for item four (4) ninety percent (90%) of the students said 'yes' to instructional resources such as tape recorder, audio-visual aids provision by the school authority. Also, 90% of them agreed that teachers should improvise teaching resources where there is no provision.

In item six, ninety-six percent (96%) of respondents said students should be motivated in the oral skill. The last item in the analysis says that teachers and the school authority should encourage intensive and extensive reading. One hundred and nine respondents which represent 90% of the sample agreed to the statement while 10% of them disagreed.

Oral Test (N=114)

Table 3: Identification of sound symbols in words

S/N	Sounds	Words	F	Pass (%)	Fail (%)
1	/jug:/	New	40	35	65
2	/I/	Women	6	5	95
3	/ð/	Bathe	63	55	45

	/æ/	Stipend	32	28	72
	/i:/	Amoeba	12	11	89
	/ æ/	Ask	26	23	77
	/ʒ/	Measure	74	65	35
	/ʃ/	Pressure	19	17	83
	/ŋ/	Sing	91	80	10
1	/ D/	Cot	35	31	69

The analysis on oral test of table three above shows that out of 121 test papers that were given out to respondents, only 114 were answered, while the remaining 7 papers were returned unanswered. The consonant sound no. 1 /ju:/ which is represented in the word ‘new’ has the frequency of 40 students who passed, this is 35% of the respondents. In the vowel sound /I/ as in women, 5% only passed. The consonant sound /ð/ in item 3, is a dental fricative in the word bathe, has 55% of pass. In item 4, the diphthongs vowel sound /ai/ in the word stipend has the frequency of 32 which represent 28% that passed. The long vowel sound /i:/ in amoeba has the frequency of 12 representing 12% pass. The short vowel sound /æ/ as in ask has 23% of respondents that passed while 77% failed. In item 7, the voiced consonant sound /ʒ/ as in measure has 65% pass. Also, the voiceless consonant sound /ʃ/ in the word pressure has 17% pass. But the nasal sound /ŋ/ as in sing has 80% pass, while the short vowel sound / D/ as in cot has 31% pass while 69% of the respondents failed the test.

Discussion of Findings

From the findings, it is obvious that the cause of failure or poor performance of students in senior school is basically administratively. The findings clearly showed that most of the English teachers in Senior Secondary Schools are not proficient or incompetent in teaching the language, as majority of the respondents affirmed to this claim.

In the analysis of the test of orals, it is revealed that the cause of failure in identifying some English sounds might be interference of the mother tongue. For instance, the voiceless consonant sound /ʃ/ as in pressure was confused with the voiced consonant sound /tʃ/ as in church. Also, the Nigerian indigenous languages do not have the long /i:/ in their sound system, so there is the possibility of using /i/ which is a common vowel sound in Nigeria languages for short /I/ and long /i:/.

As for the voice consonant sound /ð / in bathe was substituted for /d/ sound as in ‘dog’. Learners always find substitute in their indigenous language if they feel the sound is similar and this result into error. Another reason for failure could be faulty teaching to learners or wrong application of what was taught.

The implication of the findings for teachers and stake holders is that having realised that learners have internalized their individual languages before learning in school, they ought to be taught specially with audio or visual aids as instructional resources especially for oral English. The technical aids that have native speakers’ ascent need to be employed to serve as models. Teachers need to offer learners a clear reason for oral proficiency.

Conclusion

The study concludes that there are many factors which are responsible for the low performance of students in Senior Schools. Many which could be attributed to the school, teachers and the government or the stakeholders in the education system. English is the language of communication in Nigeria, a medium of instructions for instructors in schools, a

pre-requisite for students seeking admission into the university and other higher institutions, a lingua franca, a medium of communication to the rich and the poor, the affluence and the downtrodden in the society. This study is significant because the researcher believes that speaking is an active and productive skill. The major goal of all English Language teaching is to give learners the ability to use English effectively. Based on the findings, the recommendations were made:

1. The school administrator should ensure that only qualified English teachers teach English language in Senior Secondary Schools.
2. English language teachers may embark on aspect teaching, that is, those who are proficient in the oral skills could be made to teach oral English.
3. The administrators should ensure that teachers teach with instructional resources such as audio/visual aids during oral English lessons.
4. The administrators should make provision for language laboratory for easy access to students and teachers where all the phonemic symbols are placed on charts.
5. The speaking of indigenous languages and Pidgin English should be discouraged in the school environment.
6. Teachers should motivate students to speak English often by organizing debate competition among the learners. Also encouraging them to read extensively by establishing a mini-library in the class in order to ensure proficiency
7. The stakeholders in the government should make adequate provision for more qualified English teachers in the Senior Secondary Schools.

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TEACHERS' LEARNING THOUGHTS ON VERBAL DISCIPLINE PRACTICES AFTER PROFESSIONAL CONVERSATIONS

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Abstract

The purpose of this study was to establish the learning thoughts of teachers on verbal discipline practices after engaging in three day videotaped professional conversations. This was a qualitative research study of six purposefully selected teachers in one primary school in South Africa. Data were obtained immediately after the conversations through written questions. The data were transcribed and analysed using content analysis. Results showed verbal discipline as a daily and leading disciplining strategy teachers relied on and effective in dealing with learners' misconduct based on manner of usage. Teachers maintain that anger should be avoided while disciplining learners verbally. They also noted that verbal discipline is a corrective way of changing learners' behaviours against punitive measures. They mentioned learning the importance of having knowledge of the learners' backgrounds (family) before verbal discipline. Based on the findings, the study concludes that teachers should embrace professional conversations for more collegial learning to improve their classroom discipline practices. The study recommends that teachers should have background knowledge of their learners before verbal disciplining, and equally embrace verbal discipline against punitive measures.

Keywords: *Classroom discipline, professional conversation, professional learning, teacher learning, verbal discipline.*

Introduction

Classroom discipline is a sensitive and serious topic to dialogue about in schools and the society at large. How best to deal with learners' indiscipline is one school based problem that continues to challenge even the most experienced teachers. Without achieving discipline in the classroom, the goal of education, which is learning, remains unaccomplished. By virtue of their profession and the law, teachers, according to Masitsa, (2008), are responsible for maintaining discipline at school. Thus, the high rate of indiscipline among learners and numerous challenges teachers are facing daily to achieve conducive learning environment, since the abolition of corporal punishment in South African schools (Mugabe & Maposa, 2013; Ntuli & Machaisa, 2014; Zulu & Wolhuter, 2013), justify the need for teachers to engage in professional conversations around classroom discipline and, specifically, verbal discipline.

According to the Department of Education (DoE) (1998), discipline must be maintained in the school and classroom to ensure that the education of the learners proceeds without disruptive behaviour and offences. However, in ensuring that classroom discipline is maintained, teachers have adopted numerous alternatives to corporal punishment, as recommended by the Department of Education, which include verbal discipline/verbal warnings, demerits, additional work, small menial tasks, detention, and others (DoE, 2000,). Verbal discipline, according to the DoE (2000), is one of the examples of disciplinary actions for misconduct inside the classroom against learners that fail to arrive in class on time, bunk classes, fail to finish homework, fail to respond to reasonable instructions, and as well as being dishonest. Verbal discipline is also the teachers' manner of reprimanding learners for

minor acts of misconduct, such as making noise during the lesson, using of vulgar language, and wearing improper attire (Mugabe & Maposa, 2013).

Some of the categories of verbal discipline include yelling, threatening, cajoling, insulting, ridiculing, negative comments, scolding, explaining, and calming harshly (See Bloom, 2015; de Wet & Lessing, 2013; Maphosa & Shumba, 2010; Wang & Kenny, 2014). Nevertheless, how teachers apply verbal discipline can have both positive and negative effects on the learners' behaviour. Studies by Wang and Kenny (2014) and Bloom (2015) indicate that harsh verbal discipline can have an intense influence on the emotional and behavioural development of the learners. Earlier research by Sulich (2004) also shows that the manner in which teachers address or talk to learners, in the form of verbal discipline, may have fundamental implications on how the learners perceive themselves. Another study by Moyo, Khewu and Bayaga (2014) claims that teachers have, at times, mistaken verbal warning with shouting (verbal abuse) and notes that shouting can trigger anger and fear in learners. Similarly, Mugabe and Maposa (2013) uphold that one challenge teachers face is the temptation of using abusive language on learners, which, in most cases, worsens their behaviours. In response to the above claims, an earlier study by Maphosa and Mammen (2011) concludes that, if disciplinary measures result in the worsening of the behaviour of learners, such disciplinary measures are useless.

Studies by Saunderson and Oswald (2009) and Mugabe and Maposa (2013) maintain that verbal discipline is one of the disciplinary strategies teachers use frequently to maintain order in the classroom. Mugabe and Maposa (2013) claim that verbal discipline is the most applicable method of preventing learners from acts of misconduct. Other studies indicate that teachers are increasingly relying on verbal discipline to deal with learners' misconduct (Moyo et al, 2014; Mugabe & Maposa, 2013). Although a previous study (Saunderson & Oswald, 2009) claims that challenges arising from the learners and their contexts contribute to classroom disciplinary problems, Magwa and Ngara (2014) maintain that various family circumstances exert more powerful influences over learners' behaviours than anything that happens in school.

Hence, engaging teachers in professional conversation around classroom discipline to establish their thoughts on verbal discipline practices in schools prompted the researchers to conduct this study. Professional conversation entails intentionally organised formal and informal dialogue between educational professionals on educational matters (Timperley, 2015). In this study, both experienced and inexperienced teachers were offered a learning opportunity to interact on their verbal discipline practices for improvement. According to Okeke and van der Westhuizen (2020) professional conversation provides learning opportunities for teachers to exchange ideas and points of view for professional development.

The Importance of Teacher Professional Learning

Professional learning offers teachers a number of learning opportunities. These opportunities include, among others, opportunities for learning on the teachers' own terms; opportunities for problem-posing to draw on expertise and judgment within the group; and opportunity to raising problems and questions of common interest (Wood, 2007). Professional learning, according to Mayer and Lloyd (2011), involves changes in one's capacity for practice (changes in professionally relevant thinking, knowledge, skills and habits of minds) and/or changes in practice itself (enacting the new knowledge and skills in one's daily work). For Wood (2007), teachers' professional learning encompasses teachers who would assume responsibilities to carefully inquire into their present practices; consult outside expertise;

reflect on what they had learned from experience and engage in conversations with one another.

Studies have noted that most of the existing education policies are influenced by the pedagogical reasoning that teachers learn from their colleagues and peers (Msomi, van der Westhuizen & Steenekamp, 2014; Opfer & Pedder, 2011). Studies have also revealed that much of the recorded improvements and advancements in teachers' capacity are attributed to the formation of teacher professional learning community (Horn & Little, 2010; Wood, 2007). These appear to be in line with Msomi et al. (2014), who state that professional learning ingredients, including deliberate reflection, inquiry, and sharing insights as imperative in the improvement of teacher learning. A study by Tillema and van der Westhuizen (2013) also notes that teacher professional learning appears to be more active when it occurs in practice within a classroom and school community context, through courses and workshops that are specifically designed to target the professional development of the participating teachers. An earlier study by Pedder, James and MacBeath (2005) argues that the constructivist perspective has influenced much of what researchers know about teacher learning. However, social constructivism encourages teachers to be actively involved in the learning process, to create knowledge, and to reflect on it, and how their understanding is changing as a result of it (Bargate & Maistry, 2015). Thus, professional conversation affords participated teachers a collegial learning opportunity on their discipline practices for professional development.

Theoretical Framework - Social Constructivism

Social constructivism provides the theoretical lens that enables the explanation of the dynamics of teacher learning from professional conversations. According to Swan (2005), the main objective of social constructivism is to explain how knowledge is constructed through social interactions. Mbatia (2012) suggests that learning occurs through the internal construction of knowledge and through experiences gained by the learner, as well as the learners' social interactions with significant others (in this scenario teachers within a context-specific environment). Au (1998) posits that research on learning that is informed by the social constructivist perspective is underpinned by the understanding that individuals must engage in authentic literacy activities that are not contrived for practice.

Generally, the social constructivist perspective derives from the works of the Russian psychologist, Lev Vygotsky (Manditereza, 2014). According to Manditereza (2014), Vygotsky's central concern is the influence between thought and language. Vygotsky's most important contribution is his emphasis on the sociocultural nature of learning (Slavin, 2012). In his book, *Mind in society: The development of higher psychological processes* (1978), Vygotsky demonstrated that meaning-making during the construction of knowledge is closely related to the social as well as historical and cultural contexts. This would seem to inform the reason for social constructivist researchers to place great emphasis on the context in which those who were researched dwell. According to Bhattacharjee (2015), Vygotsky's importance to social constructivism reverberates from his theories about language, thought, and their mediation by society. That is why Vygotsky views the individual as active but 'mediated from the outside in' (Donald, Lazarus & Lolwana, 2010).

It is important to bear in mind here that Vygotsky's (1978) theories emphasise the imperativeness of social interaction in the development of the cognitive processes (Galloway, 2010; Giridharan, 2012). To fully explain the functionalities of his theories, Vygotsky (1978) made use of three concepts, namely: the More Knowledgeable Other (MKO), Zone of

Proximal Development (ZPD), and Mediation (See also Bargate & Maistry, 2015; Manditereza, 2014). In Vygotsky's theories, emphasis is placed on meaningful learning interactions, in which both the learner and the teacher share active involvement; where the presence of the committed expert would progressively enable and assist the less experienced learner to learn. Vygotsky's usage of MKO refers to the active involvement of "someone who has a better understanding or a higher ability level than the learner, with respect to a particular task, process or concept" (Galloway, 2010). Within the framework of adult learning (teachers), the dynamics of MKO would appear to play out through the varying learning mechanisms that aim to support the less experienced teacher in his or her efforts towards the implementation of verbal discipline to improve students' learning.

Methodology

This study is part of a larger research on teacher learning about verbal discipline in professional conversations. Given that this particular paper is only interested in the learning outcomes of the conversations, a generic qualitative design was adopted. Generic qualitative inquiry investigates people's opinions, attitudes, beliefs or reflections on their experiences in the outside world (Percy, Kostere & Kostere, 2015). Generic qualitative design (Bellamy, Ostini, Martini & Kairuz, 2016) normally draws strengths from one or more qualitative approaches. An earlier study by Kahlke (2014) claims that generic studies draw on one or more established methodologies to build a research design. Based on the above explanations, the generic qualitative design adopted here draws strength from the main design of the study - ethnomethodology to establish teachers' learning thoughts on verbal discipline practices after professional conversations.

A purposeful sampling method was used to select six teachers from one primary school in South Africa that participated in the study. Before collecting data for this study, the teachers engaged in three days videotaped conversations around classroom discipline and at the end of the conversations were requested to document their learning thoughts which inform this study. The data were transcribed and analysed using content analysis steps by McMillan and Schumacher (2014). The steps include: data organisation; transcription; data coding; forming categories or themes and discovering the patterns (see McMillan & Schumacher, 2014). During data analysis, the six teachers were assigned T1 - T6 to protect their identity and privacy. For instance, T1 in this study means Teacher number 1.

Ethical clearance letters were obtained from the University of Johannesburg, the Eastern Cape Department of Education and East London District Office in which the school is located. Consent letters were obtained from both the school principal and teachers that participated in the study. The researchers made full disclosure of the research and its purpose to the participants before data collection commenced. Participation was completely voluntary, and the participants' identities and responses were protected through anonymity and confidentiality.

Findings and discussions

The following findings emerged from the teachers' written thoughts on verbal discipline practices after professional conversations:

Verbal discipline as daily and leading disciplinary strategy teachers rely on

Three of the teachers reported learning that verbal discipline is the first disciplining strategy they rely on. They admitted relying on it as the primary disciplining method before other

measures. This implies that verbal discipline appears to be the leading disciplinary strategy in schools.

Quoting the participants:

- T1: *“I have also realised that I rely on verbal discipline so much more than other discipline methods.”*
- T4: *“I have learnt that verbal discipline is the most commonly used discipline strategy. It is the first line of discipline that we ought to implement when disciplining learners.”*
- T3: *“I learnt that verbal discipline is the first step a teacher used to discipline a child.”*

The findings reveal that teachers rely on verbal discipline on a daily basis to discipline learners. They admitted using it every day as their leading disciplinary strategy before any other measures. In other words, verbal discipline seems to be the predominant disciplinary strategy in the school. This finding is in line with a study by Saunderson and Oswald (2009), which maintains that verbal discipline is one of the disciplinary strategies teachers use frequently to maintain order in the classroom. These Studies (Moyo et al., 2014; Mugabe & Maposa, 2013) are in agreement, indicating that teachers are increasingly relying on verbal discipline to deal with learners’ misconduct in schools.

Verbal discipline as effective disciplining method based on usage

Three teachers revealed learning that verbal discipline is effective in dealing with learners’ misconduct but that this depends on the manner of usage.

Quoting the participants:

- T1: *“I learned that verbal discipline is arguably the most effective disciplinary strategy when working with children irrespective of their ages.”*
- T2: *“What I have learned about it is that, it works sometimes, but sometimes it doesn’t. For it to be effective, you have to come down with the tone of your voice and sometimes to the level of the learners for him/her to understand why you as a teacher reacts in this manner. They would listen more if we speak nice, in a calm manner, lovingly and caring.”*
- T4: *“I have learnt that verbal discipline is the most effective strategy. Another thing is that the way in which you implement it is what makes it to be effective or not.”*

Verbal discipline seems to be effective in dealing with learners’ misconduct but based on the manner of usage. Accordingly, a teacher’s approach to verbal discipline appears to determine the learners’ reactions, whether positive (obedience) or negative (disobedience). This is supported by Sulich (2004), who says that the manner in which teachers address or interact with learners in the form of verbal discipline may have fundamental implications on how the learners perceive themselves. Moyo et al. (2014, p.11), on the other hand, posit that teachers have mistaken verbal warning with shouting (verbal abuse) which can trigger anger and fear in learners.

Avoidance of anger when using verbal discipline

Three of the participants noted learning that anger should be avoided when disciplining misbehaved learners, as effective discipline should be applied with reasoning, love and respect.

In their words:

- T1: *“I learned that the manner I applied verbal discipline in the past could have been inappropriate. I could have said things I was not meant to say due to anger and frustration. I therefore learned from my colleagues about the importance of avoiding being overwhelmed by emotions when administering verbal discipline.”*
- T3: *“I learned that a teacher should not be emotional when implementing verbal discipline.”*
- T5: *“I have also learned that verbal discipline does not necessarily mean, shouting at a child just because I am irritated by their undesired behaviour. I understood in the research discussion that verbal warning meant reasoning with the child to stop his/her offense.”*

The participants noted the importance of separating anger in the process of disciplining misbehaved learners. Shouting at learners out of anger or work-related issues such as stress is not verbal discipline. Applying verbal discipline when one is angry or frustrated is problematic and may adversely influence learners' behaviour. Teachers in the study described effective verbal discipline as one applied with love, respect and reasoning. Consequently, Mugabe and Maposa (2013) claim that one challenge teachers' face is the temptation of using abusive language on learners, which, in most cases, worsens their behaviours. Studies (Bloom, 2015; Wang & Kenny, 2014) postulate that harsh verbal discipline can have an intense influence on the emotional and behavioural development of the learners. An earlier study by Maphosa and Mammen (2011) concludes that, if disciplinary measures can result in worsening the behaviour of learners, such disciplinary measures are useless.

Verbal discipline as corrective measure

Three of the teachers noted learning that verbal discipline is an effective way of correcting learners' behaviour. It is corrective in the sense that it fosters behaviour that is deemed desirable for effective teaching and learning. At the same time, one of the teachers labelled verbal discipline a behavioural change agent.

According to T1, *“lastly, I learned that verbal discipline is corrective as opposed to being punitive”*. This was confirmed by:

- T3: *“I learnt that verbal discipline is not a punishment. Verbal discipline is a basic tool to change the behaviour of a child”*.
- T6: *“In situations where learners dominate the classroom, that's they become talkative and disruptive during lesson presentations or during exams, the teachers must talk and convince those learners to develop positive attitude at school”*.

Verbal discipline has also been perceived as a corrective and preferred method of changing learners' behaviour. Although, at times, it's difficult and time consuming to convince learners to stop misbehaving verbally the policy forbids teachers from using corporal punishment in schools (see DoE 2000). Mugabe and Maphosa (2013) in their study mention reprimands as amongst the corrective methods used in schools to curb learner misconduct. Thus, the South African Schools Act (DoE, 1998) maintains that the “main focus of the code of conduct must be positive discipline; and not punitive/ punishment-oriented but should facilitate constructive learning.” It is, therefore, clear that talking to learners is a better discipline than inflicting pain, which amounts to corporal punishment, which has been outlawed.

Knowledge of Learners' Background

Key to effective and successful use of verbal discipline appears to be the teacher's knowledge of the learner's background, as reported by two teachers. For example, T3 believed that

background influences learners' behaviour most of the time, while T6 emphasised that home visits may be useful in understanding the causes of misconduct.

Quoting the participants:

T3: *“Teachers should understand the background of a child before applying verbal discipline. Some cases are caused by the background of a child.”*

T6: *“Teachers should support those learners by doing home visits in order to understand the background as well as the causes of bad behaviours displayed by the learners.”*

The findings of this study highlight the importance of being aware of learners' backgrounds before applying verbal discipline. One of the participants believes that background sometimes contributes to learners' misconduct. This finding appears to confirm the findings of previous studies on the effects of learners' background on their behaviour. According to Saunderson and Oswald (2009), challenges arising from the learners and their contexts contribute to classroom disciplinary problems. Similarly, Magwa and Ngara (2014) maintain that various family circumstances may exert more powerful influence over learner's behaviour than anything that happens in school. It is important, therefore, to be mindful of the impact of learners' backgrounds on their behaviours.

Conclusion and Recommendations

The teachers reported learning a great deal from the conversations and, based on the findings, the study concludes that teachers should embrace professional conversation for more collegial learning through talk to improve their professional practices. The study further recommends that teachers should avoid anger while disciplining learners verbally, have background knowledge of their learners before using verbal discipline, and equally embrace verbal disciplining against punitive measures.

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LANGUAGE OF LEARNING AND TEACHING FROM GRADES 3 TO 4: A PEDAGOGICAL ISSUE FOR CONTENT SUBJECTS

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Abstract

The goal of this study was to explore teachers' pedagogical abilities and the role which the Language of Learning and Teaching (LOLT) plays in the learning of content subjects between Grades 3 and 4. The Sociocultural theory was used as a theoretical framework for the study which is located within the interpretive and qualitative paradigm. This qualitative investigation engages phenomenology as a relevant research design that is used in examining teacher pedagogical approaches and beliefs in content subjects. Therefore, qualitative research methods and approaches were relevant in collecting and analysing data. The study used lesson observations, interviews, and document analysis to gather data from 10 Grade 3 and 10 Grade 4 teachers. The teachers were purposefully selected from 5 Ex-Model C schools in the Free State region. Lesson observations were audio-recorded then transcribed for discourse and thematic analysis of participants' experiences. The key findings from lessons observed and interview analysis suggest a consequential link in pedagogy, LOLT and learner performance. The study assumes that teachers face difficulties in teaching in English as LOLT when faced with a combined gradation of language and content resulting in learners failing to interpret content meaning. The study illustrated that teachers' pedagogical practices do interact with learner performance hence, there is a notable learning gap experienced during the transition from Grade 3 to 4.

Keywords: *LOLT, Pedagogy, Sociocultural theory,*

Introduction

It is a common phenomenon in South African Schools to find children speaking languages which differ from the Language of Learning and Teaching (LOLT) within their schools. This results in linguistic problems which are exhibited within the content delivered in the English. According to (Qorro, 2013) the LOLT is a crucial aspect in the learning of other subjects. English as LOLT has proved to be a challenge to most South African learners who are non-native speakers of English. As a result, the students are faced with poor academic results in content subjects and learning achievement in general. Somehow, when children exit Grade 3 to start Grade 4, those learners who were performing well in Grade 3 suddenly, underperform. Some learners are left 'behind' academically and they join the 'fourth Grade slump' (Chall & Jacobs, 2003) and it becomes worse with each transitional year resulting in learners disengaging from academic work. Once learners disconnect a communication and learning gap is created between the teacher and the learner, obviously the message sent is somehow distorted and most learners will exhibit low literacy skills in content subjects. The question now is; could it be the LOLT in content subjects that has become a barrier to learning as evidenced by Grade 4 literacy levels challenges.

The main purpose was to, firstly, investigate whether learners are being taught the required LOLT Literacy competencies that match the content of the subjects taught. Secondly, compare Grade 3 and Grade 4 pedagogical approaches in content subjects and lastly, investigate the link between learner performance and LOLT in order to find out the extent to

which subject teachers integrate content and LOLT skills. This study sought to bring new knowledge connected to LOLT issues and academic challenges in content subjects between Grade 3 and Grade 4 by producing knowledge that could be used to guide subject teachers who teach through English LOLT. Therefore, this study sought to investigate the relationship between teacher pedagogy and learner performance in content subjects based on the following questions:

1. To what extent do Grade 3 and Grade 4 teachers differ in teaching literacy skills in content subjects?
2. Do subject teachers integrate content and LOLT literacy skills?

Theoretical framework

The study is situated within the Sociocultural perspective because the study highlights the ‘how’ of teaching content subjects to a diverse student population who speak English as an additional language. The Sociocultural theory was relevant in the study because the theory asserts that language and thought are linked, therefore, language plays a major role within the context of learning. According to (Moate, 2010; Vygotsky, 2012) language is a mediating tool through which content and language are constructed in the learning context. If we theorise language from a sociocultural perspective of learning that means language is the cultural transactional currency that allows meaning to be negotiated by members of a subject community. Therefore, language is a ‘vehicle for thought’.

Another implication based on the principles of the Sociocultural perspective is that the learner gets immersed in an environment where one has to draw potential meanings (Vygotsky, 2012). This reveals that knowledge production is interdependent between the individual and significant others within the social environment. According to (van Lier, 2008), the meanings will gradually become available to the learner as he or she interacts with the environment. Again, this theory states that social interaction mediates learning, therefore, the concept of mediation is instrumental to (Vygotsky, 2012) theory.

The Sociocultural theory further asserts that the learner is an active being in the environment in which he/she is immersed. The learner draws meanings from that environment therefore second language learning and teaching takes place within social interaction (Moate, 2010). The Sociocultural theory emphasizes the importance of relationships in language and learning.

The Sociocultural theories regard the teacher’s presence and the teachers’ practices as being instrumental in learning relationships. Research cited so far does not compare the impact of language practices between two Grade levels when they investigate LOLT pedagogy and performance in content subjects. Therefore, the study brought a new dimension by comparing Grade 3 and 4 in order to identify the LOLT root problems that cause learning gaps. Addressing this gap means finding out the point of the existence of LOLT problems. The problem of poor LOLT skills is experienced in Grade 4; but, does the problem start in Grade 4. Furthermore, it is that period when Grade 4s move away from learning to read, to reading to learn in LOLT. The study concentrated on both Grade 3s and Grade 4s so as to establish where the disengagement is prominent.

Background of the study

The study is contextualized within the South African education system hence the use of English as LOLT is drawn from South Africa’s legislation. The policy draws from the

constitution which spells out the language position in teaching and learning in the South African Schools Act of 1996 (Republic of South Africa, 1996). The Act bestows the obligation and choice to determine the LOLT to school governing bodies (SGB) in public schools, subject to the Constitution, SASA and any applicable provincial law.

In South Africa, according to the Language policy and according to the constitution, there is a multi-school system as far as LOLT is concerned because we have schools that use their native language and some use second or third languages as LOLT. Firstly, the first type of school uses English as LOLT from Grade 1, the second type of schools use indigenous languages from Grade 1-3, then transition to English from Grade 4. Although South Africa recognizes 11 official languages namely; Afrikaans, English, IsiNdebele, Sesotho, Sepedi, Setswana, SiSwati, IsiZulu, Tshivenda, and Xitsonga, English therefore, stands out to be the most adopted and preferred LOLT. In the Foundation Phase which is (Grade 1-3) the learners are taught by one teacher, but from Grade 4 which is regarded as the Intermediate Phase onwards, the teachers practice subject teaching. For example, in Grade 4 the learners may have 4-5 teachers. This brings us to the problem at hand where the focus is on whether Subject teachers also take time to teach literacy skills.

The issue of LOLT in South Africa

The issue of LOLT and subject content is a contentious issue in RSA bearing in mind that only about 9.6 % (Statistics SA, 2012:22) of the population are First (L1) English speakers. The rest speak English either as second (L2), third (L3), or even fourth (L4). The study also explores whether learners leave Grade 3 having acquired adequate language skills. On the other hand, do Grade 4 teachers teach language in their subjects or they just deliberate on content. According to (Department of Basic Education, 2009) every teacher is a language teacher, hence the implementation of English Across the Curriculum (EAC). In this case, English LOLT must be integrated with content subjects. To make matters worse, South Africa has a poor academic achievement record according to (Spaull & Pretorius, 2019) usually our learners are not able to comprehend meaning by the time they are in Grade 3.

Any learner who cannot use the LOLT to acquire knowledge is disadvantaged academically. However, LOLT is not the only challenge that accounts for low academic performance (Owen-smith, 2010). This shows that language is a cross-cutting issue in academic performance although the language is not the only challenge that accounts for low academic performance. This is supported by statistical examples from (Howie et al., 2017; Spaull & Pretorius, 2019).

Challenges in LOLT and statistical examples

The study's statistical examples do indicate that South African children perform poorly on international assessments of educational achievement for example International Reading Literacy survey results (PIRLS) of 2006, and 2011 as well as Trends in Mathematics and Science Study (TIMSS) surveys of (1995, 1999, 2003 & 2011). These surveys have consistently demonstrated that South Africa's performance is amongst the lowest of all participating countries. This shows that there is a gap that is already pronounced in the education system (Howie et al., 2017).

Results of the Annual National Assessment (ANA) (Department of Basic Education, 2012) prove that language is a challenge because one in 3 learners did not achieve at least 50% in schools, Afrikaans included. These figures are said to plummet (Department of Basic Education, 2012) in Grade 3 whereby almost 1 in 2 Grade 3 learners did not perform

adequately leading to 3 in four Grade 4s and 5 in six Grade 5s underperforming. The statistical figures referred to reveal that the higher the Grade the worse the performance. These statistics conclude that learners in South Africa do perform poorly, be it academic or any assessments.

Methodology

Participants and procedure

Since the study's philosophical worldview was interpretive in nature, qualitative methods and approaches were considered relevant. The interpretive paradigm entails that social actors construct reality within their context (Creswell & Creswell, 2018). The interpretive paradigm was used to unpack learning hence; the participants were observed as they were teaching. An ethical clearance was sought and granted from the relevant authorities. The study was conducted at Five Ex-Model C Primary schools in the Free State. In the South African schooling system, Model C schools are former English Medium schools which were advantaged over other schools. The Model C schools were advantaged in terms of resources and staff, hence these schools used English LOLT. The schools used are multi-racial schools whose student population is a mixture of middle class and upper-class families. The schools that were studied are still using English LOLT in all lessons except in one first additional language. To reduce on variables, the study purposefully selected (n=20) 10 Grade 3 & 10 Grade 4 teachers). The reason why the study did not use public schools was to avoid confounding variables, for example, in public schools, learners are introduced to English once they are in Grade 4 and sometimes the teachers code-switch. In order to limit experiencing extraneous variables, the study found it necessary to limit issues to schools which practice early LOLT immersion.

Research instruments

Schools were visited in this study in order to explore how reality is constructed within the classroom environment. This means that we only gain knowledge of reality through social constructions (Creswell & Creswell, 2018; Denzin, 2010). The study, therefore, observed teachers' use of LOLT as they conducted lessons. The researcher used face to face interviews and document analysis (Denzin, 2010). This study employed the semi-structured interview approach which comprises of non-standardised questions and is usually used in qualitative analysis. After lesson observations participant teachers were interviewed. Data were triangulated in order to improve reliability and trustworthiness, hence the study collected data using different methods.

Data analysis

The Saldana method of thematic analysis of data was used qualitatively. Data collected was firstly broken down into codes (Denzin, 2010; Saldaña, 2016). Data were reduced using the interpretive approach which interpreted emerging themes and patterns. The research then analysed themes and patterns in form of teacher practice, habits and similar interview responses created through Data Coding. Consequently, the thematic strands that emerged from data coding were used to discuss the findings of this research.

Findings and discussion

Data findings from interviews, lesson observations and document analysis were categorised in line with the works of (Saldaña, 2016) whose views indicate that categorisation creates

order in research by creating corresponding themes and patterns. Four broad themes emerged from this study giving rise to the following categories.

- LOLT influences teacher and learner performance
- Content Subject Teachers do not teach Language skills
- Differential Pedagogical approaches between Grade 3 and 4 teachers
- Dense Vocabulary in Grade 4 Content Subjects.

Each category is therefore discussed below.

The LOLT influences teacher and learner performance

The study findings do suggest that the LOLT influences learner and teacher performance. The study discovered the challenges as evidenced in the teacher's language proficiency. Most teachers are non-native English speakers and they speak English as a second language (L2), yet they must teach it as their first language (L1). The other inconspicuous problem is whether teachers are competent enough in the rules of another language since their first languages differ from the medium of instruction. The teachers may fail to distinguish rules of the first language (L1) from the second language (L2). Some teachers indicated that they did not study English, but they just speak English conversationally. On the whole, the interviews revealed that the learners are not receiving sufficient practice in LOLT skills, especially in Grade 4 content subjects where the learners are taught by various teachers.

From the interactions observed the teachers' level of ability either empower the learners with the required language skills or disempowers the learners. The majority of teachers stated that, according to their experience, Grade 4 learners fail because they never acquired the necessary language skills in Grade 3 hence, Grade 4 learners struggle to learn in English LOLT. A smaller percentage of teachers asserted that the system could be passing the Grade 3 learners undeservedly. In other words, content teachers were exonerating themselves from failing to attend to language issues when teaching content subjects. Interestingly, observed lessons revealed that Grade 3 learners appear more conversant since the teachers use interactive approaches so to assume they are being passed seem unjustifiable. On the other hand, Grade 4 teachers used the telling approach and the learners were given very limited opportunity to interact with the teacher. The majority of participants interviewed corroborated that teacher practices are consequential to learning because the way a child understands a subject will determine their performance. This indicates that the LOLT influences teacher and learner performance. Hence, LOLT issues were sighted as a serious challenge to learner performance.

Content subject teachers do not teach language skills

Content teachers are not integrating content with language but are mainly concerned with their subjects' requirements. The teachers of content subjects indicated in their interviews that they only concentrate on the requirements of the subject partly, because of lack of time and lack of knowledge in teaching Literacy skills. According to interview results, the language teachers explained that even though they teach language to at least 5 Grade 4 classes, the challenge is that classes are too big and with L2 learning, a teacher needs a lot of time with the students on a one to one because language involves a whole lot of skills. Hence, it is difficult to sufficiently teach and interact with all learners. Some subject teachers may not be aware of their limitations in English LOLT.

The interview results and the lessons observed indicated that the majority of Grade 4 subject teachers are mostly concerned with the content of the subjects which they teach, and not the proficiency in LOLT. The teachers seem to concentrate a lot in finishing their syllabus to meet the school's key result areas, thereby, neglecting the necessary LOLT skills. As a result, content teachers do not help the language teacher.

Different pedagogical approaches between Grade 3 and 4 teachers

The study observed different pedagogical practices of English as LOLT between Grade 3 teachers and Grade 4 teachers. The Grade 3 and 4 teachers use divergent approaches. Grade 3 teachers seem to give equal attention to content and Language because they view the learners as needing a lot of literacy assistance. In addition, the Grade 3 teachers used a lot of concrete examples wherever possible. They involved learners a lot by physically modelling to learners what they are expected to do. On the other hand, Grade 4 teachers assume the Grade 4s have acquired sufficient literacy skills, whilst in Grade 3, thus, they focus largely on the content. It seems it is only the language teachers who engage in literacy skills.

Dense Vocabulary in Grade 4 Content Subjects

From the Grade 3 books to Grade 4 books the research compared Mathematics, English and Life skills. In Grade 3, the learners study 4 subjects, and in Grade 4 the subjects translate to 6 subjects. In all these 6 subjects per day per subject, a learner is faced with new vocabulary that requires interpretation, so, without teacher assistance in Literacy in content subjects what then will happen. The problem is from the above-stated subjects, which show that a learner must learn about thirty or more new words per week, and the words have to be contextualized in order for the learners to understand. In Grade 4, suddenly, there is difficult vocabulary. In Mathematics, there is plenty of new vocabulary in addition to steep concepts; in English, the child must have a dictionary alongside, and the texts are too long for reading and comprehension. These learners are taught by more than three teachers who use different pedagogical content knowledge approaches in English LOLT in content subjects. Therefore, language becomes the barrier in acquiring content due to the quality of linguistic interactions that emerge from different content subject approaches. Grade 3 textbooks seem relevant because the learners were able to read without much difficulty. On the other hand, Grade 4 textbooks proved otherwise. On the surface, the content in the Grade 4 textbooks seemed relevant but there is a need to start by examining the length of English stories and the vocabulary density which may hinder comprehension. A struggling reader will not worry about reading a very long passage. Thirdly, it seems both subject teachers and learners need assistance in English LOLT in content subjects.

Conclusion

Findings from the study demonstrate that low academic achievement in Grade 4 has bearing on linguistic factors meaning for learners to be able to comprehend and interpret the message from the teacher there is need for learners to possess literacy skills related to the content of the subject otherwise lack in the LOLT will disadvantage the Grade 4s by creating a learning gap in education (Evans & Cleghorn, 2014).

The study established that content teachers consider language to be a lesser priority in their content subjects such as Social Science, Mathematics, Life Skills, Natural Science and Technology. The teachers must prioritise language learning since language is a powerful tool that underpins the thinking process and helps individuals to develop socially and cognitively.

The dilemma facing the South African education system today is how to deal with teacher's inability in teaching through English LOLT in content subjects.

The study concludes that how language is used in schools reflect upon learner performance and this is reflected in the views of (Brock-Utne, Desai, Qorro & Pitman, 2010; Evans & Cleghorn, 2014; Qorro, 2013) who assert that if children do not speak the language of education there is no authentic teaching and learning.

Several implications emerged from the issues that were explored in this study. Firstly, it has been discovered that it is a common phenomenon in South Africa where learners are educated in LOLT as L2 or as L3. This challenge therefore, affects teacher effectiveness in LOLT. These teachers do not appreciate that language could be responsible for low achievement in their subjects. Secondly, teachers and stakeholders need to know that it is the LOLT that is at the core of learning since it mediates between the learner and the environment, and it acts as a facilitation tool, which enables the learner to understand and to decontextualize the learnt matter. Lastly, since LOLT affects performance teachers need to reassess their roles in content lessons. It is important to note that learners should not just acquire subject-related skills; they need to acquire the subject literacy skills. This can only be possible if the content subject teachers are aware of the language demands of the LOLT. The learner textbooks analysed showed an uneven progression in content and vocabulary. Since vocabulary is a key to unlocking content knowledge Grade 4 vocabulary becomes a barrier since subject teachers give limited attention to vocabulary. From discussed findings and results analysis, the study makes the following recommendations:

Recommendations

1. Education authorities should revisit policies and take heed of LOLT challenges that are being highlighted in this and other researches.
2. The Grade 4 textbooks need revising in order to create a smooth progression between Grades 3 and 4.
3. It is recommended that a large-scale study should be undertaken to explore teachers, parents and learners' views on content structure and content progression in Grade 4.
4. This calls for the need to train and to retrain teachers in teaching relevant literacy skills in content subjects.

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SOCIO-ECONOMIC STANDARD OF PARENTS AND PUBLIC SENIOR SECONDARY SCHOOL STUDENT'S ACCESS TO ICT IN BWARI LOCAL COUNCIL ABUJA

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Abstract

This study investigated the influence of Socio-Economic Standard of Parents on Public Senior Secondary School Students' Access to Information and Communication Technology (ICT) in Bwari Area Council, Abuja. The study adopted a survey method and the population identified for the study was strictly secondary school students in Bwari Area Council (BAC). Hence, public senior secondary schools within this area council were selected. Also, the random sampling technique was used to randomly select 50 students from the selected schools in the Area Council. The instrument used for data collection was a structured questionnaire. The study administered a structured questionnaire to two hundred (200) respondents; out of which one hundred and ninety-four (194) were filled and returned. Therefore, the study analysis and discussion of findings were based on the opinions of one hundred and ninety-four (194) respondents. The data was processed and analyzed using chi-squares as a quantitative method. However, the qualitative method was based on content analysis. Findings provided that most students who had access to the computer were from family backgrounds whose income and education was high on the scale. The point is that the income and educational status of parents determined the early exposure of students to computer education in the study area. Therefore, the study recommends that to raise the present standard of students' performance, additional computers should be acquired for public schools through government intervention and assistance from the private sector.

Keywords: *Information and Communication Technology, Socio-Economic, Parents, Students, Standard*

Introduction

The use of Information and Communication Technology (ICT) is a widely accepted phenomenon in the 21st century. This is particularly related to the significance of technology to educational development and transformation. ICT has been shown to have a lifelong effect extending beyond knowledge for academic excellence to workplace productivity. However, there are crucial factors that may either hinder or promote knowledge for the utilization of modern technology in school. The role of education/school curriculum is a vital point to consider. The idea is to diagnose what obtains in the formal learning activities that as introduced to students (Cooper, 2009).

The reality is that while some secondary schools have an acute shortfall of computer technology with very few experts, others have no access to computers. This problem is most prominent in rural areas. In this wise, Educationists have consistently argued that the poor knowledge of information technology among secondary school students is a direct indication of a lack of proactive step taken by the government to address the dismal (Aderogba, 2005). This is particularly related to poor funding of the education sector which should cater for the necessary provision for modern technology. On the other hand, some scholars have shifted the blame on teachers and school management boards for poor professional practice. This

argument challenged the knowledge base of the professionals and brilliant implementation of the school curriculum (Brusilovsky, 2001).

Subsequently, the problem with the access and utilization of ICT is further extended to some fundamental issues. This is related to socio-economic standards in terms of parents' income, education, ethnic affiliation, belief system, peer group, and gender factor (Fagbulu, 2005). A study has shown that the socio-economic background of students plays a vital role in academic excellence (Anderson, 2005). This is evident in most developed nations in which access and utilization of modern technologies is a positive correlation effect of the socio-economic standard (Bridgeman, Goodrich, Kobourov & Tamassia, 2000). This evidence is also confirmed in the studies conducted in most developing nations (Emory & Tamassia, 2002). However, the problem lies in the socio-economic background characteristics of the individual student in determining the knowledge and use of ICT for academic excellence. In essence, while it may be said that some secondary school students have overcome possible hindrances in the use of ICT thereby attaining the level of proficiency; others though have access as knowledge is yet sustainable. There are also categories of students who do not have access let alone the utilization. Therefore, it becomes crucial to empirically investigate the impact of Socio-Economic Standard of Parents on Public Senior Secondary School Students' Access to Information and Communication Technology (ICT) in Bwari Area Council, Abuja. The specific objectives are to:

- i. Examine the relationship between Parent's Income and Access to ICT among Students in Public Secondary Schools.
- ii. Assess the relationship between Socio-economic Standard of Students in Public Secondary Schools and their Access to ICT.

LITERATURE REVIEW

Conceptual Review

According to Adegoke and Osokoya (2015), Socioeconomic indicators can be seen as age, sex, occupation, residential level, and social status in society. The socioeconomic level is an economic and sociological measure of an individual's work experience, family's economic and social level compared to other people, which are measured in income, education, and occupation. Marmot (2004) shows that socio-economic background is a measure of a person or group of persons' wellbeing. When discussing a family's socio-economic levels, the income earners' education and occupation are examined, as well as combined income, and individual attributes such as income, education status, health status, occupation, residential level in the society, etc. Information and Communications Technology (ICT), is often used as an extended synonym for information technology (IT) but is a more specific term that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information (Yekini, 2010).

Empirical Review

There are limited empirical studies on the case study but this study reviewed relevant and related empirical studies on socio-economic status and students' access to Information and Communication Technology (ICT). Amongst these is the work of Nikos (2004) which shows that socio-economic background influences students' access to ICT and the Internet. He argued that socio-economic background had a direct positive relationship with computer experience and an indirect negative relationship with computer anxiety and tested this

assertion with questionnaire data from a sample of 267 University Students. Heath, Maghrabi, and Carr (2015) demonstrate the relevance of parental involvement and effective school-home communication in learning.

Also, Adegoke and Osokoya (2015) investigated access to the internet and socio-economic background as it relates students' achievement in Agricultural Science among selected Senior Secondary School Students in Ogbomoso South and North Local Government Areas in Oyo State, Nigeria. Their study showed a greater percentage of students have access to the Internet but there was no significant relationship that exists between access to the internet and achievement in Agricultural science. This study is on the socio-economic standard of Parents and Public Senior Secondary Students' access to ICT in Bwari Area Council, Abuja, Nigeria.

Theoretical Framework

The study adopted the Social System Theory as a Theoretical Framework. The Social System Theory addresses, in general, questions about complexity and the organization of complexity in social systems. More specifically, it deals with questions of how socio-economic and other systems function and evolve, how systems interact with one another, how they impact one another and their environments, and how unexpected outcomes and developments emerge from system processes and interaction. Social systems consist of institutional, cultural as well as material structures. This implies that socio-economic systems control or determine human activities in a society which was also supported by the work of Yekini & Lawal (2012) and Yekini & Lawal (2009). This theory forms the foundation of the study and the theory also establishes the relationship between Socio-Economic Standard of Parents and Public Senior Secondary School Student's Access to Information and Communication Technology (ICT) in Nigeria

METHODOLOGY

Research Design, Population, and Sample Size of the Study

The study adopted the survey research design method. The population identified for the study is strictly secondary school students in Bwari Area Council (BAC). Hence, the public senior secondary schools that are within this area council were selected. The method of sampling adopted for the study is multistage which comprises purposive, stratified, and random sampling techniques. The purposive sampling was used to select the study area and was also used to select four secondary schools in the area council. The stratified sampling was used for the selection of students (both girls and boys) in each of the schools identified for the study. In this wise, the stratification is based on the proportion or ratio of boys and girls in the school register. Also, the random sampling technique was used to randomly select the 50 students from each selected school in Area Council. This is further clarified in Table 1. Therefore, the total sample size of this study is two hundred (200).

Table1: Location of Study and Sample Distribution

Area council	Senior School	Sample size	Senior School	Sample Size
Bwari Area Council (BAC), Abuja	Government Secondary School (GSS) Bwari	50	Government Secondary School (GSS) Dutse	50
	Government Secondary School (GSS) Kubwa.	50	Government Day Secondary School (GDSS) Dutse	50
Total	----	100	---	100

Method of Data Collection and Analysis

The instrument adopted for data collection in this research work is the structured questionnaire which has two parts or sections; the first section comprises of the respondent bio-data, such as age, sex, resident and level here in section one respondents are expected to tick the right option provided, while the second section comprises of the research question relevant for research analysis and in this section, respondents are expected to tick the right option from the given options. The researcher administered a structured questionnaire to two hundred (200) respondents out of which one hundred and ninety-four (194) were filled and returned. Therefore, the study analysis and discussion of findings were based on the opinions of one hundred and ninety (194) respondents. The data were processed and analyzed using chi-squares. The validation of the instrument was done by giving it to an expert to look at it.

Data Presentation and Analysis

The basis of respondents' socio-economic analysis is to show the extent to which the variables can influence the pattern of response to research questions. As often argued by social demographers the significance of socio-economic variables cannot be over-emphasized because the perception of the social world and reality is the interplay of the individual status of socio-economic (Agyeman, 2007).

Table 2: Distribution of Respondents' Socio-economic Characteristics

Sex	Frequency	Percentage
Male	101	52.1
Female	93	47.9
Total	194	100.0
Age Range	Frequency	Percentage
Less than 12	36	18.6
12-14	82	42.3
15-17	64	33.0
18 and above	10	5.2
Total	194	100.0
Parents' Educational Qualification	Frequency	Percentage
No education	11	5.7
Primary school	19	9.8
WASCE/GCE/NECO	42	21.6
OND/NCE	47	24.7
HND/First Degree	40	20.6
Postgraduate	35	18.04
Total	194	100.0
Religious Affiliation	Frequency	Percentage
African traditional religion	15	7.7
Islam	75	38.7
Christianity	104	53.6
Total	194	100.0
Parents' Monthly Income (in NGN)	Frequency	Percentage
< 7,500	28	14.4
7,500- 20,000	83	42.8
20001- 32,500	38	19.6
32,501- 45,000	34	17.5

45,501- 57500	7	3.6
>57,501	4	2.1
Total	194	100.0
Parents' Occupational Statuses	Frequency	Percentage
Civil servant/Public servant	81	41.6
Self-employed	34	17.5
Private sector employee	34	17.5
Teachers	11	5.7
Lecturers	14	7.2
Unemployed	11	5.7
Student	10	5.2
Total	194	100.0
Ethnic Origin	Frequency	Percentage
Yoruba	67	34.5
Hausa	68	35.1
Igbo	59	30.4
Total	194	100.0
Numbers of Years in the Current School	Frequency	Percentage
Less than one year	2	1.0
1-2	68	35.1
3-4	89	45.9
5-6	15	7.7
Total	194	100.0

Source: Field Survey (2019)

The results in table 2 showed various variables of the socio-economic status of respondents. On the distribution of students by gender, findings revealed a higher percentage of male students, 52.1% over female students, 47.9%. The percentage is similar across every school consulted, though there was a minor difference in the case of Government Secondary School (GSS), Kubwa as the proportion was higher, 52.0% for the female gender. The difference so observed is at the base very insignificant and this confirmed the transformation in the Nigerian education sector in terms of motivation for girl child education. The age range of students indicated that very few respondents, 5.2% in the senior classes were 18 years and above. While 18.6% of the students in senior classes were aged less than 12 years, 42.3% were between ages 12 and 14 years. The fact in this context is that while there is an increase in the number of adolescents in senior classes, there is a downward decrease in the proportion of young adults in senior classes.

The parents' educational qualification as provided among the students revealed a proportion of 5.7% of respondents whose parents were educationally deprived. At least 9.8% of the respondents identified their parents' educational level as primary school, while 21.6% attained the post-primary school certificate. There were cases of post-secondary qualification as reported by students on their parents' educational attainment. The religious affiliation of students in the study areas showed a relative percentage placing Christian worshippers higher, 53.6% than Islamic followers with 38.7%. The lowest proportion of students worshipped traditional deity.

The income distribution of parents signified a low-income trend in the study area. The distribution, in this case, was based on the combined income of both parents. Thus, 14.4% of the students put their parents' income at less than 7500 Naira and 2.1% rated income greater

than 57501 Naira. The variation indicated students from the Bwari area with relatively low parental income. Yet the proportional distribution of income in the study area reflected the reality in the Nigerian context. Generally, Nigeria is classified as one of the poorest nations in the world with the majority of its population (76%) living below the poverty line.

The occupational status revealed by students as applicable to their respective parents put civil/public service highest and this represented 41.6%. This percentage reliably strengthened the findings of the National Bureau of Statistics put the numbers of civil servant/government workers as the highest employees in the FCT (Abuja). The ethnic affiliation of students in the study area provided a similar range of percentages for the distribution. For instance, for students of Hausa origin, 35.1% was greater than or equal to 34.5% of students of Yoruba origin. The same trend goes for Igbo origin. This establishes a further confirmation that is the center of unity as inscribed in the slogan that is neither controlled by ethnic domination.

Findings also provided a relatively high proportion of students in the study areas with fair stability in their respective schools. This is indicated by 45.9% of students who had spent at least 3 years in their school, while 35.1% had spent a minimum of 5 years. The implication is that there was a heavy proportion of students with reasonable knowledge and experience of the nature of their school system.

The Level of Access to ICT Knowledge Base

The objective in this context examined the role of socio-economic standard as a determinant factor of access to computer technology among senior secondary school students. The necessity of this objective is to test the reliability of preceding findings that showed a strong correlation between socio-economic status and access to modern technology especially among students in secondary and tertiary institutions (Ayodele, 2005).

Table 3: Distribution of Respondents' Views on Access to Modern Computer Electronics

Knowledge of computer electronic	Frequency	Percentage
Yes	152	78.4
No	42	21.6
Total	194	100.0
Place of access to computer electronic	Frequency	Percentage
At school	78	40.1
At home	7	3.6
At church/mosque	5	2.6
At market	33	17.0
On the television	63	32.5
In a friend's house	6	3.1
All of the above	2	1.0
Total	194	100.0
Availability of computers in school	Frequency	Percentage
Yes	109	56.2
No	85	43.8
Total	194	100.0
Availability of computers at home	Frequency	Percentage
Yes	18	9.3
No	176	90.7
Total	194	100.0

The level of access to computers	Frequency	Percentage
Very high	12	6.2
High	29	15.0
Undecided	34	17.5
Low	78	40.2
Very low	41	21.1
Total	194	100.0
The level of academic standard consequent upon access to computer electronics	Frequency	Percentage
Very high	64	33.0
High	51	26.3
Undecided	11	5.7
Low	37	19.1
Very low	31	16.0
Total	194	100.0

The findings presented in table 3 provided a robust percentage of students with knowledge of computer electronics. This is indicated by 78.4%. Though the proportion of students with knowledge of the physical appearance of computer electronics may be significant, the percentage, 21.6% which represented students deprived of the knowledge is questionable. In real sense, it is expected that every student should have access to computer electronics in the 21st century. This is the requirement stipulated by the United Nations for Education, Science, and Cultural Organization (UNESCO, 2009).

Subsequently, it is established that there are various locations in which students accessed computer electronics in the study area. Though school centers constituted the common location where the computer is put into use as indicated by 40.1%, yet places like home, 3.6%; church, 2.6%; market, 17.0%; and television, 32.5% were vital places of computer access. Findings showed that students who accessed the computer at home in the study area had parents with high income and educational statuses.

Furthermore, there were a substantial proportion of students, 56.2% that had access to a computer at school. Though the percentage of access at school may be thought reasonable, notwithstanding the prevailing situation in the study areas, the proportion of 43.8% of non-access is worth consideration. This substantially nullified the level of supposedly reasonable access apparent among the students. Yet the socio-economic factor is vital at this level. In other words, students with low access either had parents with low income or educational qualifications and type of school.

At least 90.7% of the students could not access computer electronics at home, while only a few proportions, 9.3% of the students had access to a computer at home. The tiny portion of students with home access also had different backgrounds when compared to students without home access. On the whole, the level of access to computer technology in the study area is generally low. This is indicated by a modest percentage of 40.2%. The implication is that computer education is at the lower base and priority across school centers in the study area. Despite the contribution of computer education to academic excellence and world exposure, it is unfortunate that most schools in the study areas have found it pretty difficult to grapple with the complexities of ICT in the 21st century.

Test of Hypotheses and Discussion of Findings

H₀₁: There is no relationship between Parent's Income and Access to ICT among Students in Public Secondary Schools

Table 4: Chi-Square Test of Relationship between Parent's Income and Access to ICT among Students in Public Secondary Schools

Level of parent's income		Level of access to computer technology					
		Very high	High	Undecided	Low	Very low	Total
< 7,500	Observed	4	5	2	9	8	28
	Expected	5.1	6.1	2.4	10.3	8.9	
7,500- 20,000	Observed	39	23	4	7	10	83
	Expected	39.6	24.8	3.7	9.2	15.1	
20001- 32,500	Observed	7	10	2	12	7	38
	Expected	7.5	11.7	1.8	13.7	9.3	
32,501- 45,000	Observed	11	11	2	7	3	34
	Expected	12.1	12.7	3.2	6.9	4.1	
45,501- 57500	Observed	2	1	1	1	2	7
	Expected	2.1	1.4	1.5	3.2	1.8	
>57,501	Observed	1	1	0	1	1	4
	Expected	1.0	2.1	1.1	2.4	1.9	
Total		64	51	11	37	31	194
<i>Calculated value = 27.467; Critical value = 3.65; Df = 30; Probability value = 0.03; Decision = 0.05 level of significant</i>							

The analysis in Table 4 above is significant. The indication is that there is a relationship between the income of parents and the tendency of exposure to ICT among secondary school students. This means students with early exposure to the use of computers both at home and in school have parents whose incomes are substantial to afford a pair of modern technology for their children.

H₀₂: There is no relationship between the Socio-economic Standard of Students in Public Secondary Schools and their Access to ICT.

Table 5: Chi-Square Test of Relationship between Socio-economic Standard of Students in Public Secondary Schools and their Access to ICT

Parents' Educational Qualification		Level of computer access					Total
		Very high	High	Undecided	Low	Very low	
No education	Observed	1	2	3	3	2	11
	Expected	1.3	2.7	0.6	2.1	1.8	
Primary school	Observed	5	3	2	3	6	19
	Expected	6.0	4.1	3.0	3.6	3.4	

WASCE/G CE/NECO	Observed	23	1	2	10	6	42
	Expected	24.8	2.0	1.6	8.0	6.7	
OND/NCE	Observed	11	18	2	8	8	47
	Expected	13.2	19.5	3.2	9.0	7.5	
HND/First Degree	Observed	8	19	1	7	5	40
	Expected	7.8	20.6	2.3	7.5	6.4	
Postgraduate	Observed	16	8	1	6	4	35
	Expected	17.2	9.1	2.0	6.7	5.6	
Total		64	51	11	37	31	194
<i>Calculated value = 24.547; Critical value = 3.45; Df =30; Probability value = 0.01; Decision = 0.05 level of significant</i>							

The findings showed in Table 5 a test of a significant relationship between access to computers among students and the educational qualification of their parents. This means the level of academic exposure of parents will significantly determine the quality of education acquired by students. This also cuts across the type of school attended as this is determined by the level of parent education. The findings strongly corroborated the view of Nwangwu (2005) on the impact of parents in the educational attainment and achievement of their wards. Therefore, to overcome the problem of adult literacy is to intensify the role of professionals in this field i.e., Adult Educationists.

CONCLUSION AND RECOMMENDATIONS

Findings provided that most students who had access to the computers were from family backgrounds whose income and education were high on the scale. The point is that the income and educational status of parents determined the early exposure of students to computer education in the study area. Access to the computer in the study was measured in terms of ownership or opportunity to gain computer education. It was obvious among students with such opportunity, respondents whose parents were relatively high on the scale of education, income, and occupation edged out their counterpart. Though some socio-economic variables were significant in determining access to computer education, yet variables such as ethnicity and sex did not show any relative correlation in this aspect. This means access to computer technology is not a function of sex or ethnicity as there was no variation between access to a computer and ethnicity or sex.

On the level of utilization, the findings showed a similar level of result as revealed in the access. The point is that the utilization of computer technology among students in the study area is positively related to parents' income, education, and occupational status. The indication is that the ability and talent of proficiency in the use of computers among secondary school students can be explained in terms of family background. Though utilization was noticeable across students from either background i.e. upper and lower family, yet students from the former were better on the scale of utilization.

Therefore, the study recommends the following

- i. The role of parent income and educational status is vital in the access and utilization of computers among students. Hence, it is required that the government should raise the minimum wage for a higher standard of livings and Adult Educationists intensify campaigns for greater literacy among Nigerians.

- ii. The utilization of computer technology is generally low among students in public schools. Thus, to raise the present standard is to acquire additional computers for public schools through government intervention and assistance from the private sector.

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TRANSFORMATIVE EDUCATION FOR IMPROVED HELP-SEEKING BEHAVIOUR OF YOUNG MALE ADULTS IN A NIGERIAN UNIVERSITY

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Abstract

Improving help-seeking behaviour of young male adults is critical to reducing the burden of mental health problems globally. Diverse studies churned out in the literature have suggested various strategies for improving help-seeking behaviour. Despite these efforts, evidence from the literature suggests that more improvement is required in young male adults' help-seeking behaviour in universities. This study explored transformative practices that could be embedded in education programmes towards enhancing the help-seeking behaviour of young male adults in Nigerian Universities. In this participatory research design, six male students and four support staff in a Public University in Nigeria were recruited through purposive sampling. The participants were interviewed via semi-structured interview and focused group discussion. Thematic analysis of the transcribed data revealed that young male adults contested for mental health educational programmes that are transformative rather than informational. Four key elements came out profoundly in the data which includes disruption of norms, knowledge deconstruction in social institutions, female education, and open spaces for dialogical learning. The outcome of this study shows that designing a transformative educational programme is what is needed to activate behavioural change in young male adults' behaviour towards help-seeking.

Keywords: *transformative education; help-seeking behaviour; young male adults, critical pedagogy; critical health literacy*

Introduction

The term 'help-seeking' originated from the field of medical sociology as an aspect of 'illness behaviour', within the body of health research (Brown, 2013; Mechanic & Volkart, 1961). This concept was explained to mean the way people identify, characterise and explain signs of illnesses in their bodies as well as how they take precautionary or curative measures in dealing with these illnesses. Initial studies on illness behaviour were driven by the realisation that some people do not seek specialists like doctors, counsellors, or psychiatrists, despite their apparent symptoms. Seyi-Oderinde (2020a), defined help-seeking as behaviour involving an active decision of an individual to engage with another individual perceived to possess the skill, knowledge or considered to be in a better position to assist with regards to a problem or an event that such an individual is incapable of dealing with. In this situation, the helper is recognised as one who can provide positive and adaptive help, while the problem in question can cover a vast range, depending on the context.

Scholars and practitioners in mental health are constantly innovating strategies and measures to combat the non-help seeking behaviour of people for mental concerns – especially for young male in a Nigerian University. This is because, the continual disclination of males to seek help as compared to females, have led to an increase in the global burden of mental illness; that is evidenced by increase suicide rates, substance use disorders, poor general wellbeing, and life outcomes (Patton, Darmstadt, Petroni & Sawyer, 2018; Kaul & Irwin, 2018). The inclination to seek help is critical to access and engagement with mental health care services of individuals (Xu, Kösters, Staiger, Becker, Thornicroft & Rüsche, 2018).

However, studies have shown a high level of reticent among males, mostly young adults to seek help for their mental health care concerns (Lynch & Moorhead, 2018).

Researchers in the help-seeking field have identified some demographic factors such as age, gender, level of education, socio-economic factor, ethnicity, culture as well as system characteristics as factors that could influence the help-seeking behaviour (Divin, Harper, Curran, Corry & Leavey, 2018; Hammer, Parent, & Spiker, 2018; Seyi-Oderinde, 2020b). Studies conducted in Nigeria, on help-seeking or health-seeking as interchangeably used within the literature, have proven that socio-cultural interpretations play a critical role in determining the timing and choice of treatment for psychological illness and dysfunctions (Odinka, et al., 2015). Nevertheless, there appears to be an agreement within the body of the literature on the reason for the low or poor counselling help-seeking behaviour among young male adults. Studies have shown that gender-role socialisation and subscription to masculine norms are core factors responsible for young men's underutilisation of counselling services (Lynch, Long & Moorhead, 2018; Addis & Mahalik, 2003). Generally, men who subscribe to the traditional male gender role are inclined to be negatively disposed toward help-seeking (Yousaf, Papat & Hunter, 2015).

Indeed, the role of education in behaviour and social change cannot be undermined in the effort to enhance help-seeking. This awareness has made many scholars design differing mental health literacy programmes and psychoeducation initiatives to combat this behavioural problem (Pelham, Li & Robinson, 2017; Howard, Kathleen & Griffiths, 2018). Meanwhile, the extent to which these educational programmes are successful is directly linked to the viability and efficacy of such programmes to trigger as well as foster continued behaviour change in the help-seeking inclination of individuals. As submitted by Quennerstedt (2011), the concept of health 'is a dynamic concept which involves an interplay 'between individuals and the social, cultural and natural environments they inhabit'. Therefore, educating people towards a health behavioural change demands an educational programme that considers the complexity and dynamism of social, cultural, and natural spaces in which individual lives. Hence, the call for embedding transformative practices in educational programmes designed to enhance help-seeking.

Transformative Education

Transformative education is an alternative to the model of education labelled 'banking' by Freire Paul, in his seminal work in 1997 (Freire, 1997). This approach is believed to be viable for equipping and positioning citizens as agents of change through participatory knowledge creation, dialogue and conscientisation (Ng, Baker & Friesen, 2018). According to the authors, transformative education gives credence to the inherent knowledge and experiences of learners see them as active participants in the knowledge construction process. Moreover, the interaction between the learners and the teacher is premised on a dialogical process which integrates their multiples perspectives; cognitive, affective, and experiential knowledge to form the basis of new ways of thinking about the problem and thereby arriving at collectively decided viable solutions.

Again, Boyd and Meyers defined "Transformative education is defined as those educational practices that are informed by transformative learning theory and that foster a deep engagement with and reflection on our taken-for-granted ways of viewing the world, resulting in fundamental shifts in how we see and understand ourselves and our relationship with the world" (1988, p261) . Studies have confirmed that transformative education facilitates questioning of erstwhile taken for granted knowledge which has the capacity of

influencing change in the behaviour of individuals (Sharpe, 2016). As explicated by Mezirow (1995), this type of learning is focused on critical examination of individuals' previously held problematic or unfounded ideologies, beliefs, and feelings through dialogical discourse, rational reasoning process thereby making better decisions founded on collective conclusions. Therefore, Matthews (2017), opined that engaging the transformative pedagogy in health education programmes assist learners in becoming active participants in the knowledge generation process rather than passive recipients through listening and naming; dialogue and reflection; the promoting of transformative social action.

Several studies have attested to the viability of the transformative educational approach in behavioural change. For instance, in a study conducted by Cheatham and Shen (2003), on reproductive health proved more helpful because participants in the study were given the opportunity to investigate the origins of their own problem as against the traditional approach where health educators teach community members and share condoms. The engagement of community members as co-researchers facilitated the unearthing of unique issues such as sexual harassment and stereotyping. This enabled health educators to provide targeted educational intervention. Also, the review and critical analysis conducted by Chinn (2011), demonstrated the essential usefulness of critical health literacy as an approach to health education that helps individuals towards a critical engagement with health information. The study further showed some evidence that aspects of critical health literacy have indeed been found to be integral for better health outcomes. It is in light of these assertions that these researchers set out to explore transformative education practices that could help foster help-seeking behaviour in young male adults in Nigerian University.

Framing through critical pedagogical theory

The non-help-seeking behaviour of young male adults has been attributed mainly to socialisation processes and societal norms. Pelham, Li and Robinson (2017), identified cultural factors such as cultural biases against mental health professionals as key impeding factors against young male adults' help-seeking behaviour. In consonance with this, Addis and Mahalik (2003), opined that masculine norms and gender role socialisation also hinder young male adults from seeking help. In addressing this barrier, scholars have asserted that transformative education that fosters active participation and reflection on dominant knowledge systems and beliefs that leads to a shift in how we perceive ourselves and the world around us; is what is needed to address these barriers. It is against this backdrop that this study has adopted the critical pedagogical theory as the lens for this study.

Critical pedagogy is an approach to education that argues that knowledge is subjective, contextual, and political (Rajesh, 2014). This approach originated from the work of Paul Freire, a Brazilian Philosopher and Educator. Freire contested that the goal of education is raising the critical consciousness and reflexivity abilities of individuals such that they become aware of the content of their education and how it has been passed across (Rajesh, 2014 in Seyi-Oderinde, 2020). This type of education brings about what Sharpe (2016), described as transformative learning, where changes take place in individuals frame of reference. He further describes it as a change that causes profound shifts in mental blocks, causing changes in values, attitudes and behaviour birthed through reflection individual reflection. He further opined that this awareness should lead towards individuals' transformation and empowerment as well as social change (Dawkins-Moultin, McDonald & McKyer, 2017). Furthermore, with regards to the process of education, Friere (1997), submitted that the principles of democracy, participation, dialogues, and transformation should embed every teaching and learning encounter (Villanueva & O'Sullivan, 2019).

Pragmatically, Wallerstein and Bernstein (1988) describe critical pedagogy as people coming together in “group efforts to identify their problems, to critically assess social and historical roots of problems, to envision a healthier society, and to develop strategies to overcome obstacles” (p. 380). This approach to education is often tagged as transformative. Combining the essential elements of critical pedagogy which includes, dialogue and reflection, problem-posing and problem-solving it is believed that educating towards enhanced help-seeking behaviour change will be made possible. Thus, in the context of help-seeking, the critical pedagogical principles allow the mental health educator in collaboration with the young male adults to identify their beliefs and biases for help-seeking through problem posing, critically discuss their position without any judgement and thus cooperatively arrive at conclusions that facilitates be critically conscious behavioural change.

Research Question

In response to the above-stated challenges, one key research question was asked to guide the conduct

1. What practices of transformative education could enhance the help-seeking behaviour of young male adults in a Nigeria University?

Methodology

This study is situated within the qualitative research approach, which facilitates the exploration of peoples lived experiences within their natural setting (Creswell, 2014). The participatory research design that gives primacy to the knowledge construction of previously marginalised people was utilised in conducting the research (Higginbottom, 2017). Thus, enabling participants within the study to co-create data with the researcher and analyse as well as arrive at the conclusion of the research process (Asaba & Suarez-Balcazar, 2018). Bearing on the principle of participation, and inclusion of multiple perspectives of the participatory research design, six young male adults to facilitate manageable focus group size for thorough facilitation, engagement and participation (Nyumba, Wilson, Derrick & Mukherjee, 2018) as well as four support staff were purposively recruited from a University located in a rural town in Ekiti State, Nigeria. The ages of the young male adults ranged 21 - 31 while the support staff include one student affairs officer, a health practitioner, one counsellor and one Academic adviser. This selected sample is believed to be information-rich. The choice of the selected public University was precipitated on the researchers’ personal observation to improve the help-seeking behaviour of male students’ which emanated from a previously conducted research Seyi-Oderinde, (2020b).

Data was generated using focus group discussion with the young male adults, while semi-structured interviews were conducted with the support staff. The study adopted the six steps thematic analysis framework of Braun and Clarke (2006) framework in the analysis of the data collected. According to the authors, the six steps of doing the thematic analysis is defined as a method for identifying, analysing, organising, describing, and reporting themes found within a data set’. It involves the systematic procedure of carefully locating and classifying recurrent themes and patterns within a data set, with the aim of gaining insights into participants’ collective or shared meanings and experiences. Ethical clearance was obtained from the University of Free State, with approval reference UFS-HSD2018/1104. Permission to conduct the research was also sought from the authorities of the selected state university, and consent letters given to all participants to ascertain their willingness to participate in the research. Also, participants were informed of their rights to exit the research

process any time they felt the need to do so. In addition to these, proactive measures were put in place to ensure the confidentiality and privacy of research participants, such as giving of the pseudonym.

Presentation of Results

Theme one: Disruption of norms, ideals, and notions

In this theme, participants averred that, though these certain beliefs, attitude and behaviour appears to be accepted as the norms and ethos regarding males' help-seeking, they argued that they are not and therefore they must be changed through education. Participants indicated that the role of education in improving help-seeking should be targeted at deconstruction and reconstruction of ideologies previously held by individuals towards help-seeking.

...things may appear normal, but they are not normal. We must let everyone know things are not done like that...including the culture and the norms and everything and even the religion...we need to change about a lot of things. (Teraja)

...our mentality needs to change towards counsellors and even mental issues (Hybrid)

However, a participant argued that education should not be positioned in a way that makes African tradition inferior to the new forms of knowledge. Neither should it birth a total disregard for it. Participants clamoured for an educational approach that facilitates the critique of existing knowledge, thereby leading to the development of more rational and helpful knowledge systems.

... It is not about changing the African tradition but changing our mentality about something; we can use the positive part to our advantage. (Larry)

Conversations with the participants reveal an already existing critical approach to education. Inculcating the transformative of norm disruption and critiquing existing knowledge would assist young male adults in being favourably predisposed to mental health help-seeking as against the previous banking model used.

Theme two: Reorientation of females

Furthermore, in the discussion regarding transformative practice for improved help-seeking behaviour, participants suggested the need to provide orientation to females. This is because females are believed to be involved in perpetuating masculine ideologies that foster males non-help-seeking behaviour

A participant from the FGD session asserts that females need to be actively oriented as to disabuse their minds from perceiving males who seek help or display as being weak, but rather to provide support and take away unnecessary expectations.

...we also will not just limit our outreach to men. We will also reach out to women not to make men feel less of themselves... and you don't think as a woman that because your husband cried, you husband isn't man enough. (Water).

Another participant further asserts that the females should be encouraging and re-assuring to men, so that they can express themselves and seek help as appropriate.

There are also women who care, they're also women who want their husbands to express themselves... let the women be involved in, at least we want our men to be expressive, we want to see them cry, we want to make them feel good that they cry to us (Hybrid).

Most of the participants stated that changing norms and ideologies should not only be directed towards male students in the University alone but that various social structures within the society and that everyone needs to be carried along in the change process. For instance, religious organisations, schools, and all public arena should be involved.

Theme Three: Knowledge deconstruction of social institutions

Participants in this study believed that social institutions are places where knowledge about social issues are upheld and disseminated. They argued that knowledge deconstruction primarily needs to take place in those sectors because of the amount of influence they have over people. Speaking of social institutions, participants unanimously spoke about the religious institution and the measure of their influence in enabling or impeding help-seeking in young male adults through the type of messages passed across to its members.

The church and the school need to be oriented about these social norms that they unknowingly teach that prevent men from seeking help so that males can be assisted early. (Health practitioner)
...Pastors also need to be educated and informed so that they can assist in referring their church members to professionals as at when due. They also are teachers of right information regarding masculinity and help-seeking behaviours (Course adviser)

Another participant corroborated that some religious leaders are patriarchal in

Yes... religious leaders need to be educated, there are some pastors who would not allow females to get to the altar or perform any spiritual role in their church...it makes the male under him feel superior to the females (Hybrid)

The church, the school need to be oriented about these social norms that prevent men from seeking help so that males can be assisted early. (Health practitioner).

This point was further stressed by the level adviser who proposed designing training for pastors so that they can become referral points for males.

...Pastors also need to be educated informed so that they can assist in referring their church members to professionals as at when due. (Course adviser)

Asides from re-orientating males and female about what counselling entails and about having accurate information about masculinity, another participant spoke about the commitment and hard work that these changes require.

Sub-theme Four: Dialogical approach

Further probing on how to go about changing or modifying these norms, the male students in

the FGD unequivocally stated that the process must be subtle. One of the participants stated that males should not be stripped of their hegemonic traits but rather be taught to use it appropriately.

...we cannot take an aggressive route. We cannot challenge these norms aggressively. We must be subtle about it. Subtly in the sense that we are not saying men are no longer the head. Men are no longer powerful, no! (Hybrid)

Another participant spoke about the consequence of taking an aggressive route, he used a colloquial language commonly used within the Nigerian space, “by fire by force”, implicating this aggressive approach as the trigger for violence between both sexes. However, he recommended creating change in a loving atmosphere.

...in Nigeria now, we have a lot of groups on gender equality. Most of the group increase this inequality and violence between both genders because of their approach... group use an aggressive way that we want to change these things by fire, by force...things are not done like that...it gets complicated. So, you have to consider the males' opinion and that of everyone, you need to create an atmosphere of love. (Teraja)

Another participant interrupted:

... we are trying to make them better have a better understanding of themselves... we are humans, we feel pain, we make them aware or conscious of those aspects of themselves that are be suppressed. (Prime)

Furthermore, another participant added that changing these norms will take time and patience:

...And one thing I will add is that these things we have been saying [changing norms] not that we can eradicate them in a day, but it will take time. We can subsidise it to the minimal. Did you get the point? (S-Squared)

The ongoing discourses show a consensus among participant of the imperativeness of changing social norms, educating men and assisting the society to be aware of the need for change. The male students in this study however gave caution with regards to using aggressive means, which might put the males off and even worsen the situation.

Discussion of findings

In creating an enabling environment that facilitates help-seeking, a fundamental strategy identified in this study is the disruption of norms. Norms and ethos are known to be underlying creeds that guide most behaviours. As identified in this study, certain cultural, masculine norms, gender socialisation processes, religious beliefs and institutional practices are pervasive in the society that these male students find themselves. These ideologies have in turn influenced their beliefs, attitudes, and behaviour towards counselling help-seeking (Addis & Mahalik, 2003; Lynch & Moorhead, 2018). As argued by Geuss (1981), that ideologies are the primary impediment to human liberation and freedom. This identified

practice resonates with the assertion of Mezirow (1995), who stated that transformative education should be directed towards faulty beliefs, assumptions, and ideologies. Hence, the need to challenge and disrupt norms in this study. The following excerpts reflect participants' opinion about the disruption of norms.

As seen from the data, the mindset, conceptualisations and understanding about what it means to be a man, as well as the ideologies that they have towards masculinity and help-seeking; the culture that fuels these behaviours needs to be changed. This finding is in accordance with the submission of many scholars, who have called for the deconstruction, reconstruction and transformation of toxic masculinity (Gibbs et al., 2015, p. 208; Gibbs, Vaughan, & Aggleton, 2015, p. 301; Ratele, 2017, p. 10). For instance, Gibbs, Jewkes et al. (2015) propose that reconstructing masculinities deals with the creation of new forms of masculinities that are antithetical to the hegemonic and toxic forms of masculinities. They further, assert that these new forms of masculinities are healthier for themselves and other significant people in the lives of these male adults. Furthermore, Philaretou and Allen (2001) assert that deconstruction of masculinity involves the formation of a more balanced type of masculinity that is not gender stereotypic but that rather draws on the cultural, social, and historical viewpoints of the cherished masculine and feminine traits.

Besides that, another participant argued that changing the mindset or understanding regarding masculinity does not mean changing the African culture. The participant contested against the notion of neglecting African culture and embracing western culture. However, another participant, therefore, went further to explain the idea of changing mindsets. He stated that positive aspects of masculine cultural ideals and cultural norms could be upheld while those that are detrimental to their wellbeing and that others should be expunged. This participant's assertion aligns with the submission of Lomas (2013), who proposed critical positive masculinities as an alternative to hegemonic toxic masculinities (Lomas, 2013a). The author argues that masculinity is not inherently evil, but rather that males have the capacity to enact erstwhile forms of toxic masculinity in a positive way that is healthier for themselves and their wellbeing, and that of others. That is, counteracting toxic hegemonic masculinity tendencies or intentionally acting out constructive aspects of this form of masculinity. The ongoing conversation reflects participants' views on the type of change, process, approach and means to create an enabling environment through disruption of norms.

Furthermore, as a part of the transformative education process, participants categorically argued for involvement of women in the campaign, as it has been observed that women are also critical to perpetuating and reinforcing stereotypical norms in males. That is, the changing of mindset and ideology of what it means to be a man as to change from the women's angle as well, essentially, because of their role in socialisation processes and their influence on their partners. The finding aligns with the assertion of the Women's Commission for Refugee Women and Children (2005), that women's unintentional perpetuation of gender inequities through their socialisation needs to be addressed. Berman and McNelis (2005, p. 24) suggest that, in promoting help-seeking amongst males, the first and the foremost link is women. They argue that most of the times when males go through difficulties, their first point of contact is a woman. The authors, therefore, indicated that women should be established as a referral link for appropriate help-seeking in males. Thus, utilising critical pedagogical approaches to conscientise females towards their unintentional stereotypic behaviour will foster the enhancement of help-seeking behaviour in males.

Also, participants highlighted the importance of involving religious leaders in the knowledge

deconstruction process. In the participants opinion many of the pastors or religious leaders have patriarchal mindsets and they use their religious beliefs to support this attitude. Also, participants identified the possibility of pastors becoming referral links for psychological help-seeking, once they are aware of the uses and benefits themselves. In support of this finding, Heward-Mills et al. (2018) argue that the influence of religious leaders transcends the individual, but rather it encompasses social and cultural scopes. Their influence is enhanced through the spiritual authority they exert on their congregants as well as their status of being role models.

With regards to the approach employed in disruption of these norms, participants spoke against the current oppressive approaches that are being used in Nigeria that leave males with feelings of marginalisation and neglect. They assert that this approach could lead to grave consequences, such that the goal of the change is not achieved. Lastly, participants suggested the approach to be used in changing these norms, they suggested that a loving approach that takes one's opinion into consideration will create the desired transformation. Furthermore, participants hinted that changing the norms and ethos would not be drastic, but rather a gradual process, so that it can be sustained. These participants' thoughts are in alignment with Freire's critical pedagogy, where he asserts that education should not be oppressive but rather should be emancipatory, such that it can facilitate transformation of the individuals and society. This form of education takes place through a reflexive process that involves problem posing, questioning and critical dialogues (Dawkins-Moultin, McDonald & Mckyer, 2016; Rajesh, 2014, p. 17).

The foregoing reflects the transformative practices that are deemed helpful towards enhancing help-seeking behaviour in young male adults. These educational practices are believed to be relevant also for religious institutions and other social structures that are responsible for disseminating knowledge within the society. This is because institutional spaces, such as schools and churches are places where gender norms can be moulded and redefined. Therefore, religious institutions, given the level of influence they exert on the lives of individuals are viable platforms for redefining and teaching transformative masculine ideals.

Conclusion

This study aligns with previous research on the importance of engaging with transformative practices in bringing about behaviour change. The findings of this study revealed that norms and ethos are the key factors that influence help-seeking. Therefore, well-tailored educative programmes targeted at directly addressing these beliefs in a dialogical approach is critical to enhancing help-seeking behaviour in young male adults. This study has highlighted the ineffectiveness of the extant teaching model in fostering behaviour change and therefore, has posited four transformative practices that could be embedded in any help-seeking education programme. Designing programmes for enhanced help-seeking with principles of transformative education bears the potential of producing agentic individuals who can critically examine the beliefs holding them from engaging in timely and professional help-seeking, thereby realising their bias and thus embracing healthier ideologies that would benefit them and the society at large.

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TEACHING AND LEARNING ONLINE WITH DIGITAL TECHNOLOGIES IN GENERAL SECONDARY EDUCATION IN MOZAMBIQUE - PRACTICES AND CHALLENGES

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Abstract

The objective of this study was to explore the didactics/pedagogic methods of general secondary level teachers in Mozambique in teaching online using digital technologies. They study adopted a survey research design. The participants were four urban secondary school (Grades 8 -12) managers who were purposively selected on the assumption that they had the necessary technologies for online teaching. Data was collection using interviews. The study found that none of the schools use the online digital platforms in teaching and learning process. The excuses were that the schools do not make the internet available and the majority of students do not have capable mobile phones for online learning. In addition, it was found that many teachers do not have training on teaching with technology. All the participants acknowledge that the use of online digital technologies facilitate the teaching and learning process. However, they lamented the lack of facilities for online teaching and learning. Furthermore, they said that if given the opportunity, teachers like to use the digital technologies in teaching. It was concluded that teaching and learning through the digital technologies in general secondary levels in Mozambique still remains a challenge.

Keywords: Teaching, Online learning, Training, Digital technologies.

Resumo

O presente trabalho tem como objectivo, analisar os processos didácticos/pedagógicos utilizados pelos professores do Ensino Secundário Geral em Moçambique com recursos às Tecnologias Digitais. Assim, para o autor encontrar o objectivo, fez um inquérito por entrevista a quatro gestores das escolas secundárias urbanas que leccionam os mesmos níveis de escolaridade (8^a a 12^a classes). A escolha das escolas secundárias em referência, deve-se ao facto de que supõe-se que nas escolas urbanas e que leccionam os níveis de escolaridades em alusão, estão munidas de condições para que a aprendizagem online possa decorrer sem sobressaltos. Assim, o estudo procura responder, basicamente, junto dos inqueridos as seguintes questões: a) que meios didácticos/pedagógicos os professores usam na sala de aula? b) será que as condições no Ensino Secundário Geral em Moçambique estão criadas para que o ensino e aprendizagem online possa ser implementado? c) o que deve ser feito para que o ensino e aprendizagem online possa ser implementado no Ensino Secundário Geral em Moçambique? Do estudo constatou-se que nenhuma escola usa plataformas digitais no processo de ensino e aprendizagem. A justificação é que, por um lado, a escola não disponibiliza Internet e a maior parte dos alunos não dispõe de telefones com capacidade de ensino e aprendizagem online. Por outro lado, muitos professores não têm formação nesta matéria. Todos inquiridos reconhecem que o uso das tecnologias digitais facilita o processo de ensino e aprendizagem, entretanto, lamentam a não existência das condições para o efeito. E, lamentam ainda que se as condições estivessem criados para o efeito, alguns professores podem mostrar resistência em utilizar as tecnologias digitais na sala de aula. Baseando-se nestas constatações pode-se concluir que ensinar e aprender com as Tecnologias Digitais no Ensino Secundário Geral em Moçambique ainda é um desafio porque, carece ainda de criação das condições por parte do governo e, a não resistência e entrega total dos professores na utilização destas plataformas na sala de aula.

Palavras-chave: Ensino, Aprendizagem Online, Capacitação, Tecnologias Digitais.

1. Introdução

O presente trabalho tem como finalidade, reflectir sobre os processos didácticos/pedagógicos utilizados pelos professores do Ensino Secundário Geral em Moçambique com recursos às Tecnologias Digitais.

Assim, para o autor encontrar o objectivo do trabalho, fez um inquérito por entrevista a quatro gestores das Escolas Secundárias, Samora Moisés Machel da Beira, Secundária Moisés Machel de Chimoio, Geral Macombe – Gondola e de Dondo.

A utilidade, a necessidade das tecnologias para aprender é ferozmente defendida por uns e denunciada por outros. Uns insistem na necessidade de adaptar os sistemas educativos a um mundo em mudança e exortam a escola a criar não desempregados cultos, mas também profissionais competentes; outros se insurgem contra a perversão das missões da educação destinada a formar pessoas livres e autónomas, capazes de lançarem um olhar crítico sobre a sociedade, e não trabalhos dóceis, bem integrados numa ordem social ditada pela razão económica. Outras vezes ignoram estas posições extremas, lembram que o domínio da informação digital não pode permanecer apanágio de um escol, como foram outrora a escrita e leitura; que escola preenche plenamente a sua missão ao preparar alunos para agarrarem as oportunidades de enriquecimento individual, cultural e social oferecida pelas tecnologias, armando-os simultaneamente contra os riscos que elas comportam.

(Pouts-Lajus & Riché-Magnier, 1998, p.16)

O Governo de Moçambique para integrar e disseminar as TIC no sistema de ensino e, por conseguinte, dar face a integração do país no panorama mundial de desenvolvimento e adopção das TIC aprovou no ano 2000 a Política de Informática². A existência de uma abordagem política integrada para a introdução das TIC no sistema de ensino consubstanciou num projecto de âmbito nacional com objectivos transversais à educação, sociedade e economia denominado por Plano Tecnológico da Educação.

Á luz das ideias acima citadas pode-se depreender que parece que por um lado, as condições para a implementação e disseminação das TIC em Moçambique estão criadas; por outro, parece existir uma discrepância entre aquilo que seria o ideal e o que está acontecer nas escolas sobre utilização das TIC no contexto de ensino. E em consonância com Mazula (2018), há um fenómeno que afecta a qualidade de ensino no nível secundário em Moçambique e justifica, em parte, as excessivas reprovações.

É nesta perspectiva que nasce o presente estudo com a finalidade de perceber as práticas e desafios que os professores do Ensino Secundário Geral enfrentam no que concerne a utilização das tecnologias digitais no processo de ensino e aprendizagem, via online.

2. Fundamentação Teórica

2.1 Tecnologias de Informação e Comunicação (TIC) na Educação

² Aprovada pelo Conselho de Ministros: Resolução nº 28/2000 de 12 de Dezembro de 2000, Boletim da República de Moçambique, I Série, nº 49.

Algumas instituições internacionais como é o caso da Organização das Nações Unidas para a Educação, a Ciência e Cultura (UNESCO), recomendam a integração das TIC no processo de ensino e aprendizagem ao consideram que “tanto os programas de desenvolvimento de profissionais na activa e os programas de preparação dos futuros professores devem fornecer experiências adequadas em tecnologia em todas as fases de treinamento” (UNESCO, 2008, p. 1).

Á luz do exposto concebe-se que o acesso aos meios informáticos tornou-se, hoje, um direito do homem e, por conseguinte, uma questão da cidadania. E, cabe à escola, à sociedade e ao Estado de cada nação educar a consciência do aluno para o uso correcto deste instrumento pedagógico.

De acordo com Gonçalves, Moreira e Corrêa (2019), actualmente, as tecnologias digitais são facilmente acessíveis e bastante amigáveis, proporcionando a comunicação e o acesso a novos conhecimentos, mas também a interacção entre pessoas de diferentes idades fomentando o envelhecimento activo.

Assim, de acordo com Moreira e Monteiro (2012), na Educação, se verifica um grande consenso em termos do papel e da necessidade da utilização das TIC no processo de ensino e aprendizagem. E, considera-se que utilização das mesmas ajuda a aumentar a qualidade de ensino, tornando-o mais apelativo e motivante, através do trabalho colaborativo que as TIC promovem entre aluno - aluno, aluno – professor e professor – professor.

2.2 Ensinar e Aprender Online com Tecnologias Digitais

As tecnologias digitais têm um impacto na educação, na formação e na aprendizagem, graças ao desenvolvimento de ambientes de aprendizagem mais flexíveis e adaptados às necessidades de uma sociedade com grande mobilidade (Comissão Europeia, 2012).

Em consonância com Moreira e Monteiro (2012, p. 8), entende-se por aprendizagem online “o processo de construção de conhecimento e de desenvolvimento de competências propiciadas ou mediadas através da Internet, com ou sem a utilização de um Sistema de Gestão de Aprendizagem”.

Goulão (2011) identifica quatro áreas de conhecimento do professor: conhecimentos sobre os conteúdos a leccionar, conhecimentos sobre o desenvolvimento humano, conhecimentos tecnológicos e conhecimentos didácticos e pedagógicos. Assim, de acordo com a autora, o professor deve conceber e estruturar os conteúdos e as actividades e utilizar diferentes recursos apelando a diferentes formatos e estratégias.

Coll e Monero (2008) ressaltam que a Internet tornou-se um espaço onde se gera uma cultura própria e em que as coordenadas espaço-temporais se redefinem. Para estes autores a utilização da Internet potencia a participação de todos, crianças ou adultos, em novos hábitos comunitários, aumentando o número de microssistemas, agora virtuais, com que cada um se relaciona, gerando cada um deles a sua microcultura.

Á luz do exposto concebe-se que o acesso aos meios informáticos tornou-se, hoje, um direito do homem e, por conseguinte, uma questão da cidadania. E, cabe à escola, à sociedade e ao Estado de cada nação educar a consciência do aluno para o uso correcto deste instrumento pedagógico.

Portanto, parece que estamos a viver um novo cenário na educação em que é um facto que as Tecnologias da Informação e Comunicação estão presentes na escola e no sistema educativo. Assim, “as Tecnologias da Informação e Comunicação são um veículo que possibilita, de uma forma eficaz, a transmissão da informação, que propicia o contacto entre aprendentes, professores e materiais” (Moreira & Monteiro, 2012, p. 18).

De acordo com os autores acima citados, a aprendizagem online leva a que o aprendente se torne o elemento mais activo em todo o processo, levando à construção do conhecimento. Com efeito, nestes ambientes virtuais, o professor deve desempenhar um papel de orientador e incentivar os alunos a procurar a informação, a reflectir sobre os processos, para alcançar a apreensão dos conceitos formais. De facto, neste modelo de ensino, o papel do professor é de ser organizador e mediador entre o aluno e o sabe continua a existir, mas apoiando-se agora nas tecnologias da informação.

2.3 Formação dos Professores em Tecnologias Digitais

O uso e aplicação das novas tecnologias em contexto de ensino requerem por parte do professor que demonstre uma potencial disponibilidade e um apto conhecimento para a sua aplicação mais adequada. De acordo com Gonçalves et al. (2019), esta questão tem-se revelado um pouco problemática uma vez que nem sempre os professores possuem os conhecimentos suficientes para aplicação de metodologias baseadas em tecnologia, ou pode subsistir ainda uma resistência relativamente ao uso da mesma.

Diversos estudos e experiências das tecnologias em contextos educativos confirmam a sua utilidade (Duval, Sharpes & Suterland, 2016; Selwn, 2016, Senpent & Clembe, 2013). A literatura existente confirma igualmente a falta de treino formal para o uso da tecnologia avançadas em sala de aula (Johnso, e outros, 2014), e diversos estudos ainda que parcos, colocam em evidência uma série de barreiras para que as ditas possam ser usadas de forma mais constante e proactiva (Jokiabo, May, Spetch & Stoyanov, 2018). Estas barreiras, tais como a relutância de alguns professores para o uso das tecnologias na sala de aula, pelo facto de sentirem que não dominam esta área, e, como tal, pode atrasar o processo de ensino e aprendizagem, a crença de que algumas metodologias usadas pelos professores não permitem o uso de tecnologia, sendo, portanto, totalmente afastadas das praxis docente, a falta de tempo, para cumprir o programa uma vez que podem surgir falhas tecnológicas que podem coarctar o processo da prática pedagógica, constituem aspectos que não se podem negligenciar quando se pensa no uso das novas tecnologias na sala de aula (Gonçalves, Moreira & Corrêa, 2019).

Relativamente aos pontos acima citados, sobre as barreiras que os professores têm tido no que concerne ao uso e aplicação das tecnologias no ensino, há que reflectir sobre as condições criadas pelo governo de cada nação para que as tecnologias digitais sejam implementadas e disseminadas no processo de ensino e aprendizagem.

Ou seja, há que fazer uma reflexão sobre as seguintes questões:

1. uma vez professores formados na matéria do uso e aplicação das tecnologias no ensino, será que nas Escolas Secundárias de Moçambique existem por exemplo, Computadores, Internet?
2. Com todas estas barreiras quais são outras barreiras que o professor do Ensino Secundário em Moçambique tem tido?
3. Para o caso do Ensino Secundário em Moçambique, será que o ensino online tem funcionado?

4. Metodologia

4.1 Tipo de abordagem do Estudo

O presente estudo é meramente qualitativo. Com efeito, para a sua operacionalização, elaborou e aplicou um inquérito por entrevista a quatro gestores das Escolas Secundárias, Samora Moisés Machel da Beira, Secundária Moisés Machel de Chimoio, Geral Macombe – Gondola e de Dondo.

A escolha das escolas acima referidas deveu-se ao facto de que, todas elas são urbanas e leccionam os mesmos níveis de escolaridade (8^a a 12^a classes). E supõe-se que nas escolas urbanas e que leccionam os níveis de escolaridades em alusão, estão munidas de condições para que a aprendizagem online possa decorrer sem sobressaltos.

Pelo tipo de abordagem que o estudo apresenta, para a análise dos resultados, fez-se a análise de conteúdo. Ou seja, análise das respostas dos inquiridos e de seguida, reflecti-las com base nos vários autores que abordam das TIC apresentados na fundamentação teórica.

Como trabalho, o autor procura responder, basicamente, junto dos inqueridos as seguintes questões: a) que meios didáticos/pedagógicos os professores usam na sala de aula? b) Será que as condições no Ensino Secundário Geral em Moçambique estão criadas para que o ensino e aprendizagem online possa ser implementado? c) O que deve ser feito para que o ensino e aprendizagem online possa ser implementado no Ensino Secundário Geral em Moçambique?

3.2 Validação do Instrumento de Pesquisa

Para a validação e confiabilidade do instrumento usado na presente pesquisa, o investigador, antes de fazer um teste - ensaio do instrumento, que consistiu em fazer pelo menos duas entrevistas com base no guião a elementos do universo a estudar, que não fizeram parte do grupo de sujeitos da investigação principal, e analisá-las de seguida no sentido de saber se os objectivos previstos foram ou não alcançados, primeiro, consultou a dois responsáveis de instituições escolares do Ensino Secundário Geral de Moçambique sobre as perguntas relacionadas com factos potencialmente sensíveis. Assim, a informação recolhida através das entrevistas preliminares foi analisada por meio de uma análise simples de conteúdo cujos objectivos da análise foram: encontrar temas que representam as variáveis mais importantes a estudar na investigação principal e perguntas potencialmente sensíveis.

Nesta perspectiva, tanto na aplicação do teste - ensaio do guião da entrevista assim como do guião da entrevista final, como se pretendia uma grande flexibilidade por parte do entrevistado, a ordem das questões foi em função do desenvolvimento da entrevista. Com efeito, o investigador começou por fazer perguntas sobre experiências actuais ou próximas para quebrar o gelo; depois desta fase, o investigador avançou com questões factuais ou de conhecimento. No âmbito da condução da entrevista, o investigador se apresentou ao entrevistado como alguém que queria aprender.

3.3 Amostra e Técnica de Amostragem

No estudo, participaram quatro gestores das Escolas Secundárias do Ensino Secundário Geral de Moçambique. Assim, a escolha dos quatro sujeitos que participaram no estudo baseou-se em dois critérios: a) ser professor da escola; b) ser pedagógico ou director da

escola. Assim, para cada escola, foi seleccionado apenas um gestor indicado pelo director da escola.

4. Resultados e Discussões

Das questões colocadas constatou-se que nenhuma escola usa plataformas digitais no processo de ensino e aprendizagem. Por um lado, muitos professores não têm formação nesta matéria. Esta barreira da implementação e disseminação das TIC no processo de ensino e aprendizagem no Ensino Secundário Geral em Moçambique é explicada por Johnson e outros quando afirma que, a literatura existente confirma igualmente a falta de treino formal para o uso da tecnologia avançadas em sala de aula. A mesma barreira também é frisada por Gonçalves e outros quando refere que o uso e aplicação das novas tecnologias em contexto de ensino se tem revelado um pouco problemática uma vez que nem sempre os professores possuem os conhecimentos suficientes para aplicação de metodologias baseadas em tecnologia, ou pode subsistir ainda uma resistência relativamente ao uso da mesma.

Com este cenário em que os professores não tem formação no uso da plataformas digitais na óptica do professor torna difícil implementar e disseminar o processo de ensino e aprendizagem online no Ensino Secundário Geral em Moçambique. Por outro lado, os gestores dizem que a escola não disponibiliza Internet e a maior parte dos alunos não dispõe de telefones com capacidade de ensino e aprendizagem online.

Todos inquiridos reconhecem que o uso das tecnologias digitais facilita o processo de ensino e aprendizagem, entretanto, lamentam a não existência das condições para o efeito. Estas afirmações dos inquiridos também são afirmados com base nos diversos estudos e experiências das tecnologias em contextos educativos confirmam a sua utilidade (Duval, Sharpen & Suterland, 2016; Selwn, 2016, Senpent & Clembe, 2013).

Segundo os inqueridos, para que o processo de ensino e aprendizagem possa ocorrer é necessário que seja no mínimo disponibilizado aos professores o acesso a Internet, capacitação dos professores para que possam utilizar as plataformas digitais na óptica do professor, disponibilização de computador portátil aos professores e Tablete aos alunos. E, lamentam ainda que se as condições estivessem criados para o efeito, embora receia-se que alguns professores possam mostrar resistência em utilizar as tecnologias digitais na sala de aula, as aulas que estão paradas hoje devido a situação da pandemia do Covid-19, não estariam totalmente paradas.

Com estas constatações pode-se conceber que ensinar e aprender com as Tecnologias Digitais no Ensino Secundário Geral em Moçambique ainda 'é um desafio porque, carece ainda de criação das condições nas escolas, capacitação dos professores para utilização das TIC na óptica do professor, não resistência e entrega total dos professores na utilização destas plataformas na sala de aula.

5. Conclusões

No presente trabalho, pode-se elencar as seguintes afirmações na forma de conclusão: As escolas do Ensino Secundário Geral em Moçambique, que constituíram a amostra, não dispõem de recursos tecnológicos para que o ensino e aprendizagem online possa ocorrer sem sobressaltos; Os professores do Ensino Secundário Geral de Dondo, Samora Moisés Machel da Beira, Chimoio e Macombe, não têm capacitação no uso e aplicação das tecnologias digitais na sala de aula;

Todos gestores inquiridos reconhecem a utilidade do uso e aplicação das TIC no contexto do ensino; Nenhum professor das escolas que constituiu a amostra usa plataformas digitais no processo de ensino e aprendizagem;

Para que o processo de ensino e aprendizagem online possa ser implementado no Ensino Secundário Geral em Moçambique é necessário que as escolas sejam apetrechadas em recursos tecnológicos e capacitação dos professores sobre a utilização das TIC na óptica do professor.

Portanto, ensinar e aprender com as Tecnologias Digitais no Ensino Secundário Geral em Moçambique ainda ‘é um desafio porque, carece ainda de criação das condições por parte do governo e, a não resistência e entrega total dos professores na utilização destas plataformas na sala de aula.

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RETHINKING CURRICULUM AND INSTRUCTION FOR THE 21ST CENTURY EDUCATION IN AFRICA³

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Abstract

Effective and efficient education in African countries has become a continental imperative given that Africa is lagging far behind other regions of the world in human development indices. Although, Education and more Education is recognized as the panacea for development needs, why has African countries not benefitted maximally from their education to the level of other regions of the world which were at the same levels of development sixty years ago before political independence? There is therefore the need to look again at education in African to identify what African countries are not doing or what they are doing badly in their education in order to find a new direction and move the continent forward. Rethinking education in Africa therefore involves the entire gamut of education: Goals and objectives, Planning, Curriculum, instruction, assessment, infrastructure, funding and sustainability of good and effective practices. The main thrust of this discussion is the curriculum and pedagogy that should drive education in Africa for the 21st century knowledge economy in a hyper competitive global environment. What should be the contents of school curricula in African countries, and how should such curricula be delivered to ensure the beneficiaries of education graduate with skills and competences that enable them contribute meaningfully to the development efforts of their communities, their nations and their regions? These are the main questions which this discussion is geared to suggest answers to so that education in Africa would move forward, retain in Africa the competitive, creative and innovative graduates to work for their countries and for Africa.

Keywords: Education, Rethink curriculum, Innovative pedagogies, 21 century skills.

Introduction

Education is the acquisition of knowledge, skills, attitudes, values, aspirations and new motivations for the betterment of the individual and his/her society. Education is therefore a planned activity for the citizens of a particular society based on the needs of the society, its worldview, history, available resources and the environment. The main purpose of education is to train the new generation of a society to acquire desirable knowledge, skills and attitudes to enable them live suitably safe and productive lives by contributing to sustainable management of their environment and the development and wellbeing of their society.

In Africa, the educational enterprise appears to be too weak for far too long a period that Africa appears to have been left behind by other regions of the international community in terms of development, prosperity and progress. Regions that started with the African Region such as the Asian, South American, and Middle East have mostly left the African Region within the unenviable ‘third world bracket’ and moved forward to join the first world countries in terms of economic development, prosperity, effective and efficient education systems, low unemployment rate, stable political governance and peace. These regions have significantly increased educational access to their citizenry and used relevant science and technology education and training to bring about socio-economic development, creation of jobs and wealth, prosperity, happiness and peace.

³ Keynote presentation

Since post-independence era, many African countries have achieved some strides in their education, but these strides are not enough to engender progress at various sectors of their economies. Unemployment, poverty and low economic productivity are rife in many African countries. What go on in some African countries are various forms of crises and socio-political upheavals, armed struggles (Cameron, Mali, Nigeria, D.R Congo, South Sudan), economic woes (Nigeria), sit-tight governments (Uganda, Egypt), instabilities Cameroon, Nigeria), mass migrations (most countries), various forms of religious bigotry (Nigeria, Somalia), ethnic cleansing (Nigeria, Somalia, Cameroon) etc. Given the circumstances African countries have found themselves, many African children are denied their right to basic education of good quality. This is a right the UN wanted to ensure for children when in 1948 she declared **ELEMENTARY/BASIC EDUCATION OF GOOD QUALITY as a Fundamental Human Right (UN, 1949)**. Every government is therefore bound to ensure that all children have access to basic education of good quality as of **RIGHT**, not privilege.

As at January 2018, over 32 million children in Africa at primary school level, 28.0 million at junior secondary school, and 37.0 million at the secondary school level, (Total 97.5 Million) were out of school (Director, UNESCO, 2019). The population of out-of-school children (OOSC) must have increased since 2018, especially given the impact of Covid-19 on country economies and the education sector all over the world. These 97.5 Million children who are denied basic education by their countries cannot have opportunity for secondary or higher education. These helpless children grow into youths and adults that can hardly contribute meaningfully to the development of their societies because they hardly have any employable skills. They become poverty-stricken, easily used to foment trouble by political elites and bad guys in their societies. Much has gone wrong with education in Africa, and changes need to be made in various aspects of education in order that Africa would move forward.

Obanya (2016) correctly stated that an individual can get an education from four approaches:

- Incidental Education (learning from isolated incidents in the course one's life, eg watching sports event)
- Informal Education (learning as a result of the experiences one gathers and what one makes sense of through insight, everyday social interactions, and awareness at different stages in life while participating in various socio-economic and cultural activities – eg meetings etc)
- Non-Formal Education (learning semi-organized as a response to specific functional needs, like being a provost in a cultural association or an apprentice in a workshop), and
- Formal Education (learning organized and formalized with curriculum, specialized trained teachers, specialized equipment and learning resources, established infrastructure, developmental in structure, hierarchical from lower levels to higher levels, assessment/examination bodies leading to acquisition of certificates at various levels).

All the effort exerted to give education in the society is to enable the citizens develop fully their various talents and potentials needed to function effectively in the society. The ultimate goal of education is individual self-actualization and societal development and wellbeing. If Africa is seen to be backward relative to other regions of the world, then something is basically wrong with education or the way it is carried on in the African Region. What is wrong with our education in Africa? Why is our education not promoting African

development needs as much, and as fast as we would want? What does Africa want her education to be?

The State of Education in Africa

Western Education in Africa is inherited from European colonial powers who carved the African Continent into culturally amorphous territories which they shared among themselves for rulership and absolute exploitation. The education organized for us, the Africans, was meant to produce docile non-critical minded people who would never rise to question their masters or become independent minded in cultural/religious, scientific & technological affairs, especially in socio-political and economic affairs. The European colonialists who shared Africa among themselves in Berlin, deliberated and decided to give Africans an education that would prepare them to be slave labourers, interpreters of language of the holy book, but never to enable Africans to adequately understand their environment, critically evaluate the environment with a view to changing the poor situation of things for the betterment of their communities. They gave Africans educational foundations that would prepare them to serve the Whiteman forever as labourers and hewers of wood and fetchers of water. That is what Africans are still doing for colonial masters, more than sixty years after political independence. African education tends to equip Africans to memorize the name of plants and animals, rocks and minerals without knowing their values and what they may be used for, or how to transform them into other things that are badly needed in African communities. Because education in Africa is not rooted in African environment and world view, majority of Africa's educated people can hardly apply their learnings in problem solving in African communities, or use it to extract the abundant mineral resources, agricultural resources, or transform extracted resources into high value commodities without skills and know-how from outside of Africa. The educated who are critical minded enough find no suitable jobs in the struggling economies of African countries, they therefore migrate to serve the Whiteman's economies leaving African economies in comatose. Africa not only exports our best brains through migration encouraged by overt activities of foreign governments to attract our best brains (such programmes as American Visa Lottery and Free Visa Lottery to Canadian as well as the dangerous trans-Mediterranean and Trans-Saharan crossing into Europe by African youths) (the BRAIN DRAIN SYNDROME), but also our unprocessed cheap raw materials and minerals at a price decided by Whites, who subsequently process and export finished goods to Africa (their market) at exorbitant prices they determined also. For instance, some African countries export timber and import tooth pick from the same country that bought their timber.

It is unfortunate that Sub-Saharan Africa is moving from a state of getting low quality education handed over by colonial powers, to a state of getting no education from their present neocolonial governments that are serving the interest of former colonial powers. This trend is revealed by UNESCO's Institute for Statistics (UIS) latest Fact Sheet (no. 56) which shows that in addition to the past years of ugly data on educational access relative to Out-of-School Children (OOSC), in 2018, Sub-Saharan Africa was home to 97.5 million (37.73% of the global 258.4 Million) of out-of-school children, adolescent and youths of primary, junior secondary and senior secondary school ages, (see Table 1).

Table1: Out-of-school rates and numbers by Sustainable Development Goals (SDG) region, 2018: Out-of-school children, adolescents and youths of primary, junior secondary and senior secondary school age.

Region	Out-of-school rate (%)			GPIA	Out-of-school number (millions)		
	Both sexes	Male	Female		Both sexes	Male	Female
Europe and Northern America	2.9	3.1	2.8	0.91	4.4	2.3	2.0
Latin America and the Caribbean	9.6	9.9	9.2	0.92	12.0	6.3	5.6
Central Asia	8.2	7.2	9.1	1.21	1.1	0.5	0.6
Southern Asia	21.5	20.9	22.1	1.05	93.0	47.4	45.6
Eastern and South-Eastern Asia	9.1	10.0	8.2	0.82	32.6	18.8	13.8
Northern Africa and Western Asia	15.5	14.0	17.0	1.17	17.1	7.9	9.2
Sub-Saharan Africa	37.7	28.9	33.6	1.14	97.5	45.5	52.0
Oceania	9.3	8.4	10.2	1.18	0.7	0.3	0.4
World	17.1	16.6	17.7	1.07	258.4	129.2	129.2

Notes: GPIA = adjusted gender parity index (female/male out-of-school rate). Male and female out-of-school numbers may not add up to the total number because of rounding.

Source: Extracted from Fact Sheet No. 56, September 2019, UIS/2019/ED/FS/56

The UIS data sheet shows that at all three levels of pre-tertiary education, Sub-Saharan Africa bears the biggest burden on OOSC, indicating that a large population of school aged children is not enrolled in any school. Why are Sub-Saharan African children not accessing their fundamental human rights in terms of right to education? Have children and their parents in Sub-Saharan African countries lost confidence in western education? If parents and their children have lost confidence in the education offered in schools what are the possible reasons for that situation? What do they want from western education and how can that be made available to them in the school? Without urgent action, the state of children's access to education will likely get worse as the region faces an expected rising demand for education due to a growing school-age population (UNESCO, 2019). There is therefore a need to find out what goes on in African schools to understand why there is massive population of OOSC in Africa.

The education sector in African countries is bedeviled with many obstacles that can precipitate massive lack of access and extremely high dropout rate that account for very high population of OOSC in African countries. The education offered in African schools does not seem to respond to the needs of the learners in terms of the types of skills and competences they require for survival and success in the 21st century knowledge economy, hence the high dropout rates. For instance, a survey on why boys in South Eastern States of Nigeria dropout massively from school revealed that the principal reason given by the dropouts for rejecting formal schooling in preference to apprenticeship in trading and artisanal pecuniary economic activities, was that what they learn at school does not help them in life, especially in their business interest (Center for African Settlement Studies and Development [CASSAD], 2005). Thus, it can be concluded that many African school aged children drop out from school due

to their negative perception of the school curriculum and instruction. This is a strong indication of the need for rethinking various aspects of formal education in Africa.

The 21st century Knowledge Economy and the Demand of the workplace and employers of Labour

The 21st century promises to be very competitive in all spheres of personal individual life, national life and all human endeavours. It also promises to be very competitive on international scale. Only the individuals or nations that are prepared for these competitions would thrive during this 21st century. Individuals and indeed nations are usually prepared for all aspects of life through education and training. We are still at the first quarter of the 21st century. From the events of today the 21st would be different from any other century. There is a palpable ‘Band-Wagon Scenario’ whereby those who jump into the moving 21st century wagon move and enjoy the wagon and its concomitant contents, while those who are reluctant or undecided, or lack capacity to jump onto the wagon are left to languish behind, suffering losses, poverty and regrets. The 21st century band wagon is very fast moving and nations or individuals who wish to join must come out prepared. Preparing to live well in the 21st century society involves the acquisition of appropriate quality education for creativity, innovation, and competitiveness. The appropriate education would be dominated by SCIENCE and TECHNOLOGY, ARTS and HUMANITIES. Any form of education that makes the recipients critical minded, creative and innovative would invariably make them competitive and suited for the envisioned 21st century global society. This global society lives and thrives on knowledge and its transmission.

The human history is replete with wars, colonisation, and economic, socio-political and cultural imperialism. Weaker nations have for long been subjugated by stronger nations. Nations are weak usually because they have poor quality education, wrong visions in terms of educational disciplinary choices, which results in low level or lack of creativity and innovativeness among the citizens, leading to low socio-economic productivity, weak military strength, and high level of dependency on other nations for almost everything, including feeding their populations. The problems of individual and national weakness can be overcome through appropriate education and training. The strong nations educated their citizens and built their strength in the classroom.

The world of work has become extremely complex and is completely in perpetual flux due to rapidly changing knowledge and technologies. The work environment no longer demands only specialist skills based on subject disciplines, the demands of employers of labour have changed drastically from disciplinary specialists to generalists who are very adaptable and flexible, with a complement of different skills and competences. Table 2 shows a list of skills and competences demanded of applicants who wanted to respond to job advertisement in the Guardian Newspaper (Nigeria) of August 1st, 2006.

Table 2: Selected Recruitment Criteria from Job advertisements in a Nigerian Daily (The Guardian, 01 August 2006)

1.Goal-oriented	11. Strong leadership skills
2.Results-driven	12. Conceptual and analytical skills
3.Dynamic	13. Presentation/convincing skills
4.Computer literate	14. Well networked
5.Ability to synergize	15. Team-oriented
6.Ready to take initiatives	16. Ability to prioritize a
7.Strong organizational skills	

8.Excellent interpersonal skills 9.Excellent written and, 10. Oral communication skills	complex workload 17. Deadline-driven 18. Ability to cope with stress 19. Independent-minded 20. Adaptability and flexibility
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Source: Obanya (2006)

Andrews (2015) conducted a study to determine what skills and competences employers of MBA graduates seek most for recruitment, as well as to find the competences and skills most difficult to find. Table 3 shows the results of the study. The 1320 respondents from over 600 companies also indicated that the skills in column A are the most sought after, and also the hardest to find among job-seeking MBA graduates. Other skills and competences identified by the 1320 respondents as critical to recruiters are: communication, leadership, creative problem-solving, strategic thinking etc.

Table 3: Skills and Competences most sought after by Employers of MBA graduates in The USA in 2015.

A	B
Skills most Desired by Employers of MBA graduates, and most difficult to Find (USA) <ol style="list-style-type: none"> 1. Communication 2. Leadership 3. Creative Problem-solving 4. Strategic Thinking 	Other Skills and Competences demanded by MBA graduate recruiters <ol style="list-style-type: none"> 1. Ability to work collaboratively 2. Adaptability 3. Analytical thinking 4. Decision-making 5. Entrepreneurship 6. Global mindset 7. Industry-related work experience 8. Initiative/risk-taking 9. Motivation/drive 10. Quantitative skills

Source: Andrews Margret (2015)

Tables 2 & 3 show the various skills and competences demanded by employers of labour. By inspecting these skills and competences, one would observe that they are not subject matter or content based. Rather they are cross-cutting and can be developed through participation in the study of several school subjects when they have been taught using certain strategies/methods to ensure that these competences and skills are acquired by the learners in the course of participation in the learning activities/process. They are aspects of what is called the implicit curriculum (Obanya 2006). These skills are not examinable through paper-and-pencil tests, but can be assessed through rational but focused anecdotal observations at different occasions and conditions/situations. Educational institutions which produce labour for the market or world of work must therefore target to develop these skills and competences in their graduates.

The knowledge economy has created the demand for ‘knowledge workers’ and has consequently transformed the world of work from specialist domain to generalist domain. There is therefore need to reappraise/rethink which curriculum content is of the most worth and how best to deliver it. The implication is that the curricula and instructional strategies used in Africa’s educational institutions must be reappraised in the light of the demands of the labour market. The 21st century Education should be education for effective and rapid

adaptation to rapidly changing needs, technologies, work styles, especially the changing functional requirements of practitioners in the world of work environments. The 21st century calls for **Re-education** of the existing work force, **Re-skilling** and **Re-tooling** for purposes of adaptation to changing environment of the school, the workplace, general society, food, health, sports and recreation. Thus the 21st century education demands critical mindedness, creativity and innovativeness on the part of the teacher and the education system generally to turn out products that would be creative, innovative, critical minded, problem-solving and competitive locally and internationally. If we are to **RETHINK** the school curriculum and instruction, the entire gamut of education is affected, since the effectiveness of corrections applied in some sections of the education system can be compromised by neglect of other sections in the same education system. The implication is that rethinking the entire education should begin with identifying new goals for education for the individual and his/community by conducting education sector strategic planning followed by curriculum planning and design and finally by curriculum implementation. If, for instance, education has been elitist and failing to equip the recipients with appropriate knowledge, skills and attitudes necessary to control their environment and maintain socio-economic competitiveness, then the new goals of education should include to enable the recipients understand and manipulate his/her environment with a view to manipulating and dominating it, and acquire knowledge, skills and attitudes to enable the graduates fit into a modern society and remain competitive in it. Given that education in African countries fails to get us to where we want to be, there is the need to rethink the entire education edifice to make it serve us and our countries better. How shall this be done?

Rethink the Goals of Education in the Society

The dissatisfaction with education in many African countries for not serving the much expected developmental needs of the society as much and as fast as we would wish, warrant the review of the goals of education. The goals of education have to be generated from the world view of the society, the citizen's needs and aspirations, and the resources available in the society. The African environment is typically different from Western societies, hence the educational models and curricula we borrow from the West most often fail to scratch our societal concerns or meet our survival needs. Once the African countries have derived the goals of education based on the social/philosophical world view, environment and developmental needs, educational objectives would become relevant and useful to the people in their environment.

Rethinking Curricula Objectives and Contents

African countries need not adopt/adapt curricula from countries outside of Africa. The world of knowledge is infinite and selecting what should go into the school curriculum is very difficult. It should be of utmost consideration to decide which contents of knowledge and skills are of greatest value/importance towards the needs and aspirations of the learners in their society. Each country needs to have some level of decentralization in the curriculum used in various regions of the country. This is necessary to ensure that curriculum contents are somehow tied to the local environment of learners at the basic and secondary education levels. If education is to help the citizenry understand their environment with a view to dominating it and sustainably exploiting and manipulating its resources for the greater good of the people, the curricula should focus on the resources of regional segments of the country. The curriculum should also contain elements that would keep the learners competitive at the national and international levels. The home grown curricula would tend to discourage brain drain from Africa to other nations. This is because educated citizens based on home-grown curriculum would find enough challenging issues in their environment to resolve and would

therefore not find it very attractive to migrate to other nations. African countries with similar historical experiences may support one another based on peer review and identification of African best practice. I am aware that Ghana adapted the Nigerian-developed 6:3:3:4 system of education and the basic education curriculum and she is doing very well with the system and the curricula.

Conduct Education Strategic Planning that Would Emphasize the New Goals and Approaches to Education Development

Having assembled a home grown curriculum that would serve the education needs of the African country, orderly development of education becomes paramount. Education is so important for development that it must meticulously be planned in a strategic way to ensure orderly development and achievement of goals and objectives.

Educational strategic plan is a plan which takes a far reaching view of the total gamut of the education sector with an intention for a sustained and systematic development of the sector through strategic and impactful investments, targeting aspects of or the whole sector, so as to reach predetermined objectives on scheduled time frame. Thus, strategic planning of the education sector involves strategic choices of what to target for investing the scarce resources available to the sector each year. It is usually a long term plan (e.g. 10-year plan) with rolling operational plans (e.g. 3-year operational plan) during which strategic investments are made in prioritized impactful areas of need (strategic objectives) that would have the greatest positive impact on the targeted and downstream aspects or the entire education sector. The prioritized areas of immediate educational investments are determined by full analysis of the sector and identification of areas of strategic importance.

Educational strategic planning is such that the planners and plan-implementers are aware and in control of the direction of development of education sector over a given plan period. For instance, if science and technology education (STE) and training are identified as the areas of strategic importance to fast-track job creation and socio-economic development, investments and activities would be focused on these areas until targeted objectives are achieved. Strategy is important because the resources available to achieve these goals are usually limited. Such a strategic plan focusing on STE would bring about investments in STE teacher production and supply, teacher continuous capacity development, teacher motivation, provision of books, infrastructural development, provision of equipment and teaching/learning resources, building of new science and technical schools, popularization STE in the country, improvements in teacher morale and creation of small scale and medium enterprises (SMEs) where the products of the school would find jobs. If this is done there would be increased learner enrollment at all levels, improved teacher effectiveness, learning achievement, rate of production of STE graduates, and attainment of the critical mass in the production of creative and innovative STE personnel that would, over sometime, crystallize the socio-economic development of the country. The next level could be focus on literary education and humanities. In this way, all aspects of education in the country are systematically addressed and education becomes stable and productive, leading to national development and competitiveness.

Rethinking Technical and Vocational Education and Training (TVET)

In some African countries Technical and Vocational Education and Training (TVET) is looked down upon by parents and their children, who prefer purely academic education at the primary and secondary school levels, (Obanya, 2004). This is because of poor policy direction by the government, leading to wrong public perception of TVET as inferior and

meant for academically weak students. The public perception of TVET as inferior has made that important aspect of general education unpopular, and consequently, majority of African children do not enroll in TVET programmes at the secondary school level. In Nigeria, for instance, handicraft or local craft which is in the primary school curriculum is hardly implemented by teachers, and the ministries of education do nothing about the situation. The implication is that the very roots of technological skills development are not nurtured and made to grow, but stifled early by teachers, especially those who collect money from learners in place of handicraft which is stipulated in the curriculum (Obanya 2016; Njoku, 2006).

African countries should give TVET the pride of place and the emphasis it deserves by supplying technical schools with well trained and motivated technical subject teachers and well-equipped workshops. Actually, TEVT should be a critical part of general education for everybody so that every student develops technical skill and positive attitude towards technical work and problem solving. This would enable African countries to produce the required critical mass of technical human power with the requisite skills for various kinds of available artisanal jobs in the society. In this way Africa would stop importing the so-called foreign/expatriate technical skills to work in agriculture, mining and other extractive industries, building construction, repair and servicing of machines, electrical installation & refrigeration, welding and various other artisanal jobs. Africans would do the entire jobs. This is creation of wealth.

Rethinking Pedagogy in African Schools

Researchers in pedagogy have continually proved empirically that lecture method of teaching is dominant in African classrooms at all levels, and that lecture method is very ineffective compared to most other instructional designs and strategies (Hardman, 2005; Njoku, 2004 & 2009; Obanya, 2016; Savage, 1998). Researchers have commended the benefits and superiority of various teaching methods and instructional designs such as cooperative learning, project method, group work, peer teaching and so on, and continually recommended them for adoption in African classrooms but teachers fail to adopt the recommended innovative instructional approaches while sticking to lecture method (Njoku 2016)., Lecture method reduces the learners to passive listeners and note takers. As Opara and Nwafor (2020) put it, lecture method is boring and fails to promote the much needed critical thinking. Lecture method also fails to emphasize the implicit aspects of the curriculum which enable learners acquire important attitudes and competences for survival and success (collaborative, cooperative, tolerance, democratic attitudes, leadership, initiative, problem solving, critical thinking etc) in modern workplace (Njoku 2016; Obanya, 2006).

These skills and attitudes are acquired as components of the implicit curriculum embedded in certain teaching methods and strategies. Figure 1 shows the average information retention rate of learners when lecture method is compared with some other methods/strategies.



Figure 1: Learning Pyramid (Obanya, 2016)

This figure amplifies the need for paradigm shift in the implementation of school curricula in African schools. The shift has to be from passive approaches to activity-base/experiential learning approaches, which ensure that the implicit curriculum is achieved along with the explicit curriculum (subject matter contents).

Teachers at all levels of education in African schools should adopt the following active-learning teaching approaches due to their multiple learning impacts and benefits to learning outcomes:

- Cooperative Learning (CL)
- Collaborative Learning Instructional Designs (CLID)
- Problem-Based Instructional Designs (PBID)
- Project Based Learning (PBL)
- Field Trip/Excursion
- Industrial attachment/Industrial work experience
- Term paper writing and presentation by individuals or learning groups
- Study questions and take home assignments
- Group neighbourhood homework and assignments
- Discussion method (Whole class Discussion and Group Discussion)
- Students Debate on relevant academic/political/sociological etc topics and concepts that can evoke pros and cons.

Rethinking Teacher Production and Supply

Overwhelming majority of current serving teachers may not be able to teach their subjects in a way to achieve the paradigm shift being proposed in this paper. This is because of their inadequate initial training and lack of in-service support for capacity development in technical workshops to make up for the skills and knowledge gaps needed in classrooms. This situation calls for a total rethinking of African teacher production and supply value chains in the education system. This can be done in a number of ways:

Align Teacher Education Curriculum Contents with their Jobs needs in the classrooms

Teacher education must align with the provision of the curricula the teachers would be implementing at the level of education at which they would be deployed on graduation,

especially at the basic and secondary education levels. This would enable the young teachers be at grips with the curricular contents they are expected to implement. There should also be a period of mentorship by experienced teachers at the school level, to help the new teachers overcome their early difficulties in handling their subjects effectively. The appropriate teaching strategies and methods as indicated above should be the major contents of the teaching methodology courses and the teaching practice exercise organized for the student-teachers in training. Microteaching practice should strictly focus on student-teachers adopting and trying their hands on active learning strategies enumerated in this paper. The graduates should have the capacity to implement various forms of active learning models of teaching in their classrooms.

Continuous teacher capacity development to improve life-long and life-wide learning

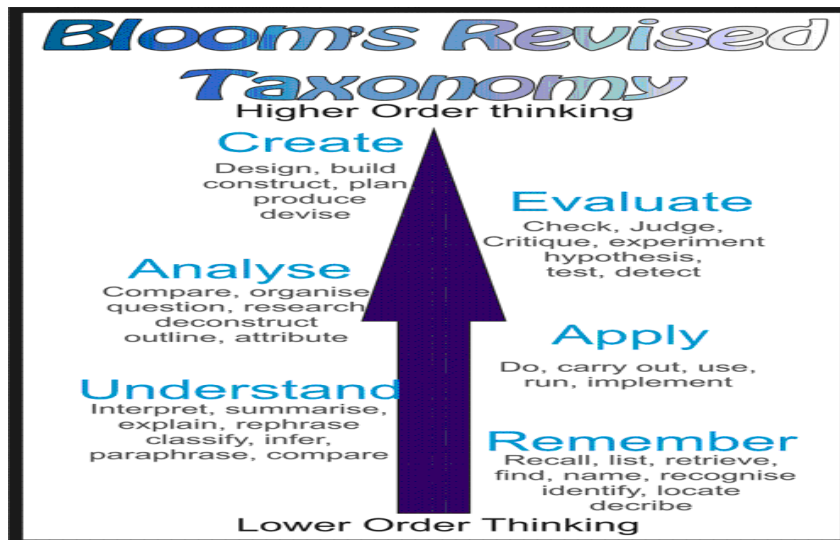
There is need for continuous updating of the knowledge and skills of school teachers to keep them competent and effective in curriculum implementation. In the modern knowledge economy, curricular contents are very dynamic and in constant flux. This is because there are rapid and constant changes in information and knowledge, as can be accessed from the internet. Teachers should therefore be life-long learners in order to keep abreast of developments in their careers. This underlines the need for continuous teacher capacity development. Teachers should be helped through continuous training to appreciate the need for life-long learning in addition to mastering the use of emerging technologies and new knowledge that are constantly infused into existing curricula. The ministries of education should ensure that teachers are made to remain competent through regular capacity development so that they would do their jobs well.

Sustainable Teacher support Programmes

Many teacher education institutions in Africa lack basic facilities for effective initial training of teachers. It is critically important that adequate resources should be deployed towards the teacher education programmes in all institutions that produce teachers. All serving teachers need to be trained in e-teaching/learning. Teachers need capacity to carry out virtual teaching so that they can reach the students in their homes and other safe environments especially during this period of Covid-19. Teachers need to be supplied with computers and trained to be digital savvy in conducting virtual instructions. Publishers of books should provide e-books and other e-resources for teachers and their students. Distance learning and virtual classrooms and interactions have come and can no longer go away. It is the new normal of the post-Covid-19 era. Africa needs to embrace it whole and entire.

Rethinking Examinations and Assessment techniques of learning outcomes

Learning outcome assessments and examinations in African countries, especially in Nigeria, have been one of the weakest links in the education system (Obaya 2006). This is because examination result, which a product of education, is considered in isolation of the inputs and processes that gave rise to it (Obanya, 2010). Teacher-made tests and assessment instruments do not often meet the expected quality standards because most of the test items in teacher-made tests concentrate on the lower levels of cognitive domain to the abject neglect of higher order outcomes in analysis, synthesis, evaluation and creativity (Njoku, 2017). Again, results of teacher made tests should inform remedial teaching and guidance and counseling services to the learners, (Njoku, 2017). If the learners failed to demonstrate mastery of the contents after teaching as exemplified by assessment outcomes, remedial teaching and counseling are called for to improve learning and help the learners surmount their learning difficulties.



<http://allihoov.blogspot.com/2013/09/weekly-writing-cooperative-learning.html> Retrieved: 2/9/20

Often external examinations fail to balance the proportion of question items to effectively cover the entire spectrum of Bloom's Taxonomy of Educational Objectives (Njoku, 2017). The preponderance of lower order questions prevents the learners from pushing higher their efforts to attain higher order objectives of learning. This reduces the effort at creating critical minded graduates who are capable of creativity and innovation. Teachers and students limit themselves on what will suffice to pass the external examinations only. Much as remembering and understanding are very important because learners cannot attain higher order learning objectives without accomplishing these lower levels, the teachers need to motivate the learners to work harder towards attaining higher order levels of thinking by creating assessment instruments that focus on higher order objectives of teaching and learning. The students who have been trained to attain higher order thinking skills would invariably pass the examinations that demand lower order thinking from the examinees.

The relative neglect of effective assessment of psychomotor and affective domains of educational objectives leaves much to be desired in many African national education systems, including Nigeria, Kenya, D. R Congo etc, (Njoku, 2020). Teachers and examination bodies should strive to effectively and consistently assess the affective and psychomotor outcomes to improve teacher practice and learners' learning styles and study habits. Teachers' capacity development programmes should include contents on building their capacity in the construction of good quality assessment items in all educational learning objectives, including the affective and psychomotor domain.

Resourcing of the Education System

The need for adequate funding of education in Africa cannot be over emphasized. Many countries of Africa tend to grossly underfund education presently, spending about 5% of their Gross Domestic Product (GDP) on education (African Development Bank, (ADB), 2020). According to the Bank, the major problem of education financing in the African Region is high level of inefficiency leading to an annual \$40 billion gap in education financing. The African Region indicates the worst efficiency index in education financing when compared with other regions, (ADB, 2020). This is not right. African should not allow education to obligatorily depend on financial aid from donor countries. If Africa wants good education

systems, the national governments must not only fund education properly, but ensure that corruption is eliminated and high efficiency of spending is maintained through budget tracking and anti-corruption activities of the government. All African countries need to consistently raise the education share of their annual budgets and the percentage of GDP that goes to education. It is only in this way will African countries improve their education system and produce the critical mass of educated and competitive citizenry that would propel economic development in Africa.

Conclusion

In this paper I briefly discussed the state of education in Africa and found it weak in many aspects. The weaknesses have made it difficult to produce the needed critical mass of critical minded, creative and innovative personnel that would be able to fight emergencies like Covid-19 Pandemic. I have suggested that the entire gamut of education in Africa should be re-engineered if Africa is to break away from under development and poverty. I have also suggested how this could be done to strengthen education in Africa to enable the continent produce the required quality and quantity of human power to lead the African nations out of the wilderness of poor capacity to handle its challenges, export of raw materials and minerals, unemployment, poverty and socio-economic and political crises.

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