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“Rethinking Teaching and Learning in the New Normal”



Proceedings

Editors

Clement Simuja
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Jude Che

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Preface

On 26 - 28 October 2022, a group of education researchers from 5 countries gathered in a virtual space to discuss ‘Rethinking Teaching and Learning in the New Normal’, in the 9th edition of the South Africa International Conference on Education (SAICEd 2022).

This Book of proceedings contains the full papers that have gone through a rigorous, blind peer-review process. We received 78 submissions (35 abstracts and 43 full papers). However, 28 full papers were accepted for publication.

The SAICEd 2022 organising committee would like to thank all participants for their contributions. We would also like to thank 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 tirelessly to produce the proceedings.

Prof A. Mji
Conference Chair

Review Process

In total, 78 manuscripts in different areas within the field of education were received. Of these manuscripts, 43 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 accepted the 28 full papers for inclusion in the proceedings.

Editors:

Dr Clement Simuja

Prof George Chitiyo

Dr Christian Ugwuanyi

Dr Jude Che

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IT'S TIME FOR CHANGE: CONSIDERATIONS FOR DEVELOPING A CHILDREN'S PARTICIPATORY RIGHTS FRAMEWORK IN EARLY CHILDHOOD CARE AND EDUCATION FOR AFRICA

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Abstract

The realization of participatory rights through the implementation of participatory pedagogies in early childhood care and education is grossly lacking in democratic South Africa. Whilst there are models of participation that have been conceptualised in Europe there is no African framework or model of participation that can be used by teachers in early childhood care and education and more so in South Africa. In this theoretical overview, the author provides a description of participation, considering that this is a complex concept that means more than just taking part, outlining the challenges to the implementation of participatory pedagogies and considerations for an African framework of participation. Such an overview is highly needed as it will contribute immensely to research, policy, practice and considerations for the development of an African framework of participation.

Keywords: participatory rights, early childhood care and education, African model of participation

Introduction and background

The recognition of children's participatory rights and the implementation of children's participatory pedagogies in early childhood care and education has gained increased impetus internationally, yet progress in South Africa has been slow. Schools and early childhood centres that cater for young children aged from birth to five play a pivotal role in promoting children's rights and, more so, their participatory rights which is imperative for children's active citizenship and considered an important contributor to children's quality learning. This can only happen if teachers genuinely listen to the voices of children and support their decision making, as highlighted in articles 12 and 13 of the United Nations Convention on the Rights of the Child (UNCRC, 1989). If children's participatory rights are fully implemented it will be one of the most profound transformations in moving towards a culture of respect for children's rights, for their dignity and citizenship and for their capacities to contribute considerably towards their own well-being (Lansdown, Jimerson & Shahroozi, 2014). However, schools and early childhood centres in South Africa are not adequately involved in supporting children's participatory rights. Participation is a complex concept to understand, and it means more than just taking part (Shaik, 2020). Considering the complexity of the multiple meanings attributed to participation, implementation of participatory pedagogies is challenging, especially in a developing country like South Africa, which has been in a democracy for the past 28 years, yet the concept is lacking in a country that aspires to democracy. Considering these challenges there have been many models of participation that have been conceptualised in Europe, but to date, no models and frameworks have been conceptualised that consider African contextual realities. In this paper, I provide a policy landscape of child participation, a theoretical overview of child participation, children's participatory rights, challenges for implementation, European models of participation and look at the possibilities for an African model of child participation.

Policy landscape of Children's participation in South Africa and Africa

South Africa was one of the countries that ratified the United Nations Convention on the Rights of the Child (UNCRC, 1979). Currently, in South Africa, children live in a society that is protected by the Constitution (SA Presidency: Office on the Rights of the Child, 2012), which has the highest respect for children's rights, ensuring children's equal access to all opportunities and promoting the goodwill of all children. During the drafting of the Constitution, the National Committee on the Rights of the Child (NCRC) played a pivotal role in ensuring that children's rights were highly prioritized within the Constitution. The Constitution is the primary legislative framework for children's rights delivery in South Africa. The Bill of Rights, which forms part of South Africa's Constitution, protects human rights for both adults and children. Equality is the first right stipulated in the Constitution, which ensures full and equal enjoyment of rights and freedom and guards against unfair discrimination on the grounds of race, gender, religion, disability, language and age (SA Presidency: Office on the Rights of the child, 2012). The UNCRC (1989), the South African Constitution (1996), the Organisation for African Unity (OAU), Charter on the Rights and Welfare of the Child, the National Programme of Action for children in South Africa as well as legislation and national policies were adopted as tools to create an environment that would promote the delivery of rights for children in South Africa (SA Presidency: Office on the Rights of the Child, 2012). Whilst these policy initiatives were prioritised, the implementation of children's participatory rights is still challenged. In Africa, the Africa Charter on the Rights and Welfare of the Child (ACRWC) is the regional document that contextualised children's rights in a diverse Africa which includes unique African issues such as harmful cultural practices (African Union, 1990). The ACRWC was enforced as a result of the marginalisation and exclusion of the majority of African states in the drafting of the CRC (Sloth & Boezaart, 2017). Whilst this has been the case, there has been some inadequacies of the CRC in addressing the cultural problems of child soldiers and harmful cultural practices as reported by Nyarko, (2018). The effectiveness of the ACRCW is still not determined and there is a lack of data to support how children's participation through how their voices are elicited is lacking.

Child participation from a European perspective

Participation whilst commonly understood as taking part, involves how adults genuinely listen to the voices of children and take their decisions seriously. Participation is evident when teachers implement what children say or communicate through their drawings depending on whether children are too young and do not have the verbal capacity to express themselves. It is important that participation does not feature in a tokenistic way (Hart, 1992).to simply reveal that it looks good on paper but in reality, children do not benefit from their participation.Children's participation must be supported from the earliest stages of schooling (Council of Europe, 2017; United Nations Committee on the Rights of the Child, 2005). Young children spend considerable time in ECCE and it is in this space that teachers must create the foundations for genuinely inviting children's participation. Participation if well supported, can result in how quality is attained in early childhood care and education (Sheridan & Samuelsson, 2001). Participation can also result in positive developmental outcomes (Bryant et al., 2010). A democracy is built based on the participation of children and when this happens it can result in children's active citizenship (Hart, 1992). It is important that participation is active (Lundy, 2007), which can empower children and not passive which can result as a restrictive force which disempowers (Lundy, 2007). Participation can also be understood as an important value that contributes to inclusion and can be the outcome of shared projects (Luciano, 2016). The arguments supporting child participation are important to consider as Kjørholt and Qvortrup (2000) indicate that it is in

the best interest of children as it contributes to their development of individual identity, competence and a sense of responsibility. Children's involvement in debate and I would argue that when younger children participate as teachers seek their views, through listening to their voices establishes the pivotal space for social democratization as it highlights the needs to accord these rights to a disenfranchised group (Sloth-Nielsen, 2016). It is important that children provide us with their views as we will not be able to get this from any other source as many times it is the adults who think on behalf of children and decide what must happen for them rather than decide with children (James & Prout, 1997).

Child participation from an African perspective

The right of children to participate from an African perspective is aligned to child labour, harmful cultural practices and child marriages amongst other issues (Simbine & Le Roux, 2021). This perspective moves away from the idea of children as rights holders who have voice which aligns to article 12 of the CRC whereby children must be able to express their views. A Eurocentric view of the participation of children in basic economic activities is understood as harmful to the child (Laird, 2016). However, in an African perspective this practice is highly needed as it contributes to the financial stability of the family.

The emphasis on participation from an African perspective is 'action based' emphasising that children must participate in socioeconomic activities of their households and communities which will equip them to learn lifelong skills. Whilst this is the case recent ideas about education renewal in post independent Africa have readdressed the argument among African intellectuals that for education to be meaningful in Africa it must be based on wisdom, teachings and traditions of the continent's ancestors considering the irrelevance of colonial education and its influence on the lives of African people (Tedla, 2006). Transmissive teaching which is also didactic in nature assumes a product-oriented approach and results in outputs such as results of assessments and lacks the importance of critical and independent thinking. This approach is also characterized by the conforming to unquestioned obedience to authority of how education in Africa was utilized by colonial government to continue rote learning and discouraging critical thinking especially among indigenous children Ndofirepi (2013).

The Western ideas of childhood are linked to understandings of children as individuals and is linked to Eurocentric philosophy of individualism which is driven by neoliberalism and capitalism. On the contrary African ideas of childhood are driven by collectivism which indicates that life and rights of an individual are meaningless and incomplete without the rights of a group of people to which they belong. In the African context a child is not viewed as an autonomous individual but as a member of a larger group which may be an ethnic group, community or society guided by the spirit of ubuntu (Ndofirepi, 2013).

These contrasting notions of Western and African childhoods are prevalent to how participation is understood and also contributory to how participation may be enacted. These notions are important to consider when developing an African framework of participation as an African notion of childhood cannot be discarded because it opposes a Eurocentric notion but the richness of how a collectivist view of childhood can be considered when incorporating it into an African framework and model of participation.

Whilst the studies outlined here are indicative of participation, they relate to participation of children in economic activities in order to contribute to the financial welfare of their families and communities they live in and there are no studies of how children's participation contribute to improving pedagogies in early childhood care and education in Africa.

Children's participatory rights

The Convention on the Rights of the Child (CRC) 1989 was the most innovative human rights document that echoed children's rights to provision, protection and participation, these rights granted children the right to have their lives improved and considering them as public and political concern (Habashi, Wright & Hathcoat, 2012). Specifically, article 12 of the CRC highlights children's right to express their own views and the right to be heard and taken seriously. Therefore, children who are capable of forming their own views are entitled to freely express themselves in all matters that affect them and children have the right to participate from birth onwards. Thus article 12 must be applicable to children of all ages (United Nations Convention on the Rights of the Child, UNCRC, 2005, 2009). A growing recognition globally is that children's rights is not just a policy goal and moral obligation but a legal obligation as well (Ben-Arieh & Attar-Schwartz, 2013; Gonzalez et al., 2015).

Children's rights are exemplified through the South African Constitution, the African Charter on the Rights and Welfare of the Child, the National Programme of Action as well as legislation and other national policies. In particular, the Constitution 1996a and the Bill of Rights 1996b serve as legal frameworks to ensure children's rights are protected in South Africa. Section 28 of the Bill places emphasis on rights of every child and indicates a child's interest is of paramount importance in every matter concerning the child (Republic of South Africa, 1996a). These policies were adopted to stimulate an environment that promotes the delivery of rights for children (Williams et al., 2001). Whilst there has been some progress related to the advancement of children's rights in Africa, progress has been slow due to challenges with regards to implementation (Pillay, 2014) and I would argue that progress in relation to children's participatory rights in ECCE is not prioritised.

Children's participatory rights in many early childhood contexts is dominated by children's protection rights in South Africa. Although internationally there have been great strides with progression from the protectionist paradigm to the participatory paradigm whereby children are recognized as social actors and rights holders to be decision makers, the protectionist paradigm still features strongly in most South African ECCE contexts. A protectionist paradigm advocates power for adults which results in an uneven distribution of power between adults and children. This was evident in a recent study carried out by Shaik, 2021, whereby pre-service teachers were asked to use Shier's model of participation during work integrated learning. The model places emphasis on genuinely listening to children and allowing them to make decisions. The study found that when preservice teachers presented the ideas of listening to children and giving them the opportunity to make decisions the mentor teachers explained that they were not prepared to listen to children or allow them to make decisions as the way they were taught to teach is the best way and they were not prepared to change. Additionally, the study also found that when preservice teachers gave children the opportunity to make a decision regarding a movement activity, the children were surprised and informed the preservice teacher that this is the first time they were asked to make a decision and did not think their views mattered. These critical findings suggest that teachers hold the power which are created through power systems being produced through generational structures (Buhler-Niederberger, 2010).

Wood (2010) also illuminates how national curricula policies command teachers how they should behave; these types of behaviour typically force teachers to prevent children from making decisions and having a voice. For pedagogy to be transformed there needs to be a redistribution and appropriation of power (Vierira, 2017) and respect for children's participatory rights in order to strengthen children's social status, to avoid unbalanced power relationships and practices and I would argue to improve quality of learning and teaching.

The respect of children's participatory rights is considered to be an essential element of human rights based societies (Burger, 2018). As Lansdown, Jimerson and Shahroozi, (2014) highlight that the respect for children's rights is a commitment to values and principles of democracy and citizenship and to children's competencies which contribute towards their own wellbeing. Participation rights warrant that children are seen as agents whose voices must be heard and acted upon (Smith, 2016). Participatory rights also ensure that children are seen as persons with agency, who are entitled to respect, and whose voices must be heard and acted upon (Freeman, 2007; Smith, 2016). Hence these rights are grounded in the recognition of children's evolving capacities and their need to gradually gain autonomy and independent status in society (Burger, 2017; Lansdown, 2005; Lloyd & Emerson, 2016; Ruck, Peterson-Badali, & Helwig, 2014). Conditions and opportunities need to be made available for children in a space where they are able to express their choices and perspectives coupled with support and information for them to understand the process (Lundy, 2007).

There have been some studies that have explored children's participatory rights in a number of contexts such as protection and welfare services (Cossar, Brandon & Jordan, 2016; van Bijleveld, Dedding & Bunder-Aelen, 2014), care arrangements (Cashmore, 2002; Magalhaes, Calheiros & Costa, 2016) foster care placements (Nordenfors, 2016), educational institutions (Khoury-Kassabri & Ben-Arieh, 2009) and in the wider community (Kosher & Ben-Arieh, 2017). Whilst these studies have explored children's participatory rights in several European contexts, there is very little research that has been carried out in the South African context that explores children's participatory rights. In South Africa there have been very limited studies on children's participation and participatory pedagogies in early childhood care and education. For example, Shaik (2014) explored the nature of child participation as part of a PhD thesis, Shaik & Ebrahim (2015) explored children's agency in Grade R, Shaik, 2021 explored how pre-service Foundation Phase teachers are supported to enhance participatory pedagogies during work integrated learning. Shaik, 2020, investigated how cognitive coaching shaped student teachers' different states of mind and created opportunities for student teachers to expand their views on child participation. Many of these studies have focused on how teachers support children for participatory pedagogies but there are limited studies on how teachers listen to children's voices to influence the curriculum or how their voices are considered in a way that will actually contribute to improving their lives and that their voices have influence (Lundy, 2007).

Why is the realization of children's participatory pedagogies so challenging?

One of the main challenges relating to the support for children's participatory rights and participatory pedagogies is that children's participatory rights has not been highly prioritised in local government's agenda in relation to how the concept might be included in curriculum. Earlier Pillay (2014) reported that there was a lack of commitment from African leaders of many countries for considering the rights of children seriously. There is a lack of political will from local and national government to push the agenda for child participation to be implemented in practice and to be taken seriously. However there has been some improvement recently when Save the Children South Africa, 2019; Save the Children South Africa/Republic of South Africa National Department of Social Development [SCSA/DSD] 2018 emphasised respect for children's rights by highlighting the need for adults who work with children to promote, protect and respect children's rights. Internationally, the European Union (EU) Strategy on the Rights of the Child advanced participation of all children to promote their rights in all areas of life placing emphasis on the empowerment of children to be regarded as active citizens in democratic societies.

Another challenge is that teachers do not understand what the true meaning of the concept participation means. Correia, Aguiar, & Amaro, (2019) warn us that there is still an

evident lack of understanding about what participation means in some early childhood contexts and lack of awareness for children's right to participate (Correia et al., 2019). Very often teachers are not open to change. Locally in South Africa, a study by Shaik (2020) shows how some early childhood teachers who have been teaching for many years and are in the education system for a long period are unwilling to unlearn traditional ways of teaching and this impacts on advancing new ways of teaching that respect children's participatory rights. A fear that persists with these teachers is that if they are to give control to children then they will lose authority and their power lost. Another challenge is that the South African CAPS curriculum and NCF like many other curriculum policies internationally are workload heavy, teachers are confined to teaching a learning area within a limited time frame (Bae, 2009; Emilson & Folkesson, 2006). Considering that teachers might be unaware of what child participation means an African model of participation can be engaging and useful to aiding teachers in inviting children to participate. Ben-Arieh (2014) has alerted that "in order to realise the true citizenship of children, we must encourage child participation". In order to do this, we need to be innovative and develop different types of participation methods and tools appropriate for different children of different ages" (p. 578). It is thus imperative that professional's awareness is built strongly through the development of an African model of participation and the actualisation of participation within the early childhood context, then this can be a path through which through a democracy and children's active citizenship can be realised.

Why an African model of participation?

Africa is a diverse continent in which children face a multiplicity of challenges such as HIV, child headed homes, child workers, war, famine, weak governance, corruption and challenging cultural practices. Viljoen (2000) very aptly states that Africa's children are highly likely to become victims of human rights violations than adults and are prone to be victims in comparison to children from other continents. Factors of human rights violations in Africa such as poverty, HIV, Aids, warfare, famine and harmful cultural practices have a deleterious impact on children from the African continent (Viljoen, 2000).

There have been some studies that have included children's participation in Africa. For example in South Africa the South African Law Reform Commission (SALRC) established a committee to prepare legislative proposals for the development of the official government mandated report to respond to children who are in conflict of the law. (Community Law Crime, 1999). The aim was to include the voices of civil society and children aged 14 years and older and children 12 years and younger and awaiting trial in a place of safety for inclusion in the final reports. This study showcased the experiences of children and how children's voices contributed to the drafting of new legislation in relation to children who come into conflict of the law (Ehlers & Frank, 2016).

Another African study on participation carried out in Lesotho showed how the Lesotho government identified several shortcomings in the legislation of the Child Protection Act of 1980 (Ehlers & Frank, 2016). The aim was to promote the rights of children and provide a legal framework for the promotion and protection of the best interests of the child. A committee was established to include government representatives, NGO's and children and wherein the committee identified five thematic areas to create the framework. The last revisions to the Children's Protection bill were finalised in 2004. The Lesotho process of including children was underpinned by the inclusion of all committee members using culturally appropriate activities which would not have been successful had it been only the adults who were responsible for eliciting their views.

The studies above reveal how children are involved in participatory processes that are

related to legislation and are dated to the early 2000's. Additionally, these participatory processes include the participation of children who are 12 years and younger and 14 years and older. There are some studies that reveal how participatory pedagogies are enacted with older children and there is limited research that focuses on how young children's participatory rights and participatory pedagogies are realised with children in early childhood care and education from an education perspective specifically in Africa and a stark absence of an African model and framework of participation.

There have been European models of participation such as Shier's (2001) model of participation and Lundy's (2007) model of participation which have been instrumental both from a practical and theoretical perspective. These models have been used in research studies to support pre-service teachers in Grade R and the Foundation Phase to invite participatory pedagogies in South Africa (Shaik, 2021). Shier's (2001) model of participation is conceptualised as a practical model whereby the focus is on actions of practitioners. The model is designed on five levels of participation: 1) children share power; 2) children share responsibility for decision making; 3) children's views are taken into account; 4) children are supported in expressing their views; and 5) children are listened to. These levels of participation are characterized by degrees of commitment, namely "openings", "opportunities" and "obligations". Openings occur when a teacher is ready to show personal commitment to participate. Opportunities occur when conditions are met for participation to become a reality which could take place in the form of resources such as staff time, skills, knowledge (staff training) and development of new procedures. An obligation is secured when the opportunities become evident in the school's policy. Therefore, as an obligation of staff, participation gets built into the system (Shier, 2001). The model can be a useful first stage in developing an action plan to enhance children's participation.

Another contributory practical model is Lundy's model of participation which focuses on the concepts of space, voice, influence and audience. Space is referred to as an inclusive space for children to express their views and is not necessarily understood as a physical space but a space wherein children's voices are valued. Voice can be articulated in several ways and not necessarily restricted to the spoken word. It is imperative that thought be given to the multiple ways of meaning making (Lundy, 2007). Influence is important as children need to feel that they do have influence. If children feel that their voice has influence and is respected, it will promote a culture whereby they, as children, are valued and respected. Finally, children need to know that they have an audience and that the audience is influenced by what children have to say. Participation needs to be deliberate and will just not happen on its own therefore, these four concepts provide a guiding framework that teachers can use when supporting children's participation.

Both Shier and Lundy place pivotal importance on the instrumental role that teachers play in listening to and consulting with children. The importance of how children have influence is also highly evident in Lundy's model. It is important to note that these models and every other model both practical and theoretical has been conceptualised in Europe and no model of participation has been conceptualised in Africa. One might argue that these models place emphasis on generic concepts of listening and consulting that are applicable to children who live across the globe, but Africa has its particular realities, as explained earlier. However, the challenges remain as to how participation is realised in practice and therefore, an African model of participation for children in early childhood care and education is urgently needed. South Africa is in a democracy since 1994 and child participation and participatory pedagogies have not yet been realised as part of our democracy. An African model of participation has the potential to renew pedagogy by prompting teachers to use the model to ignite children's participation and active citizenship. These forms of participation will enable children to make contributions to pedagogy, to policy and enable them to be

active citizens and contributors to a democratic society.

Conclusion

This article provided a theoretical overview of child participation, its challenges for realisation in practice and what African and South African policies indicate regarding child participation. Specifically, this overview highlighted the need for developing an African model and framework for participation considering that there is no African model and framework for participation that is contextually relevant to the African context and realities of African children specifically in early childhood care and education. Such a model has the potential to influence policy, practice and research. I showed how participation has multiple meanings but the most important meaning attributes to child participation is that children's voices and decision making is taken seriously. This can only become a reality in contexts wherein teachers are ready to share their adult power and prepared to genuinely listen to children. Research on children's participatory rights, especially in African contexts is very limited and the focus on children's participation rights is mainly from a legislative perspective and not from an early childhood educational perspective. Whilst the European perspective of childhood is on individualism the African perspective on childhood is community driven. These perspectives, whilst not totally exclusive, are important to consider when developing an African model and framework of participation. Whilst this overview attempted to unpack participation, its challenges in implementation and the need for an African model and framework for participation, more empirical studies are needed in the African context about how young children's voices are listened to and how they participate. Such studies have the potential to add to the debate of children's participatory rights and participatory pedagogies which can contribute to the limited knowledge of participation in an African context in early childhood care and education.

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TRANSFORMATIVE RESEARCH IN CONTEXT: AN ARGUMENT FOR RELEVANT METHODS

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Abstract

The transformative research paradigm has emerged as a response to the limitations of traditional research methodologies with the potential to bring about significant change in the way we understand and address social problems. This worldview aims to create empowering knowledge rather than positivist's objectivity. However, this paradigm shift has not been without its challenges in terms of design, implementation, and evaluation. This study conceptualises the transformative paradigm and its challenges. It presents the methodological alignment ranging from the most suitable research designs capable of implementing a transformative research plan. This study is still located within the transformative worldview to give back epistemological power to how young researchers view research within the transformative purview. The study was analysed using conceptual analysis as a tool to make sense of the argument. The study showed that participatory research (PR), participatory action research (PAR), community-based research (CBR) and art-based research (ABR) recognise power issues and social change as well as a desire to create research that is more relevant to the lives of those who are under study. The study concludes that PR, PAR, CBR, and ABR are some of the research designs capable of implementing studies under the transformative worldview. Therefore, the study recommends that transformative research be implemented using tools that acknowledge participation, collaboration, and joint construction of knowledge towards social change.

Keywords: Transformative paradigm, research methods, research practice.

Introduction

Among the many research paradigms in social sciences, transformative paradigm has emerged as a response to the limitations of traditional research methodologies. It is based on the premise that research should be about understanding the world and changing it. Traditional research methodologies often fail to address the root causes of social issues and instead perpetuate the status quo. For example, traditional research methodologies in the social sciences have been critiqued for their lack of ability to bring about significant social change (Epstein & Salinas, 2018). In response to this, the transformative research paradigm has emerged. That is, transformative researchers work to reveal how social structures produce and reproduce inequalities for change purposes (Mertens, 2012). They hope to empower individuals and communities to effect change by doing so. Therefore, transformative research seeks to bring about significant change in how social problems are understood and addressed (Romm, 2014). However, the transformative research paradigm is rooted in critical theory, which holds that society is characterised by structural inequalities that produce and reproduce social injustice (Barnes, 2019; Mertens, 2007) which aims to challenge and transform these inequalities through research.

The transformative research paradigm has come to stay, and there is much debate among scholars about its goals, methods, and effectiveness. However, there is no doubt that it offers a fresh perspective on social science research that has the potential to effect real

change in the world. This shift away from traditional positivist and objective approaches has been motivated by a desire to create empowering and transformative knowledge rather than simply descriptive (Kravia & Pagliano, 2015). However, this transition has not been without its challenges. In terms of design, implementation, and evaluation, researchers using transformative paradigms have often struggled to find methods that are appropriate for their goals (Chouinard, 2008). Additionally, the lack of a shared understanding of what constitutes transformative research has made it difficult to compare different studies. Also, it is often value-laden and goal-oriented, which can make it difficult to create objective measures or assess the impact (Cram & Mertens, 2016). In addition, transformative research often requires a high level of engagement from participants (Flynn, 2014), which can be difficult to achieve.

Despite these challenges, the use of transformative research paradigms is likely to continue to grow in popularity in the coming years. This shift is essential to create truly empowering knowledge. Since moving away from the purely objective measure is imminent, transformative research is needed to be dissected, simplified and made easy to be understood, planned, and implemented. Based on this, this study argued the methodological alignment ranging from the most suitable research design of implementing transformative research. Since one of the first steps in conducting any research is to choose an appropriate research design, the type of research design that is most suitable for a particular study will depend on several factors, including the nature of the problem being investigated vis-à-vis its paradigmatic lens (Opoku et al., 2016; Parfrey & Ravani, 2015; Sackett & Wennberg, 1997). Hence, a question such as *what the appropriate methods are and/or research designs for implementing transformative research paradigms in research* would be answered.

Research Objective

In order to answer the above research question, the following objective is provided to pilot the study:

- The study argues appropriate methodological designs applicable to implementing transformative research paradigm.

Methodology

This conceptual study adopted a transformative worldview to lens the study. That is, the argument made in this paper is located within the transformative paradigm to give back epistemological power to how emerging researchers view research within the transformative purview (Verjee, 2010). In line with this, I contend that utilising a transformative paradigm for research enables researchers to question traditional methods and theories within their field and adopt an emancipatory approach that prioritises social change (Barlas, 2000; Mertens, 2017). This paper provides arguments supported by literature on the transformative paradigm, its methodological designs, and how they are related to the transformative worldview. Overall, the researcher believes that the transformative paradigm has great potential for enabling positive social change, with the hope that this paper will contribute to furthering the understanding of this research worldview.

To present the arguments, conceptual analysis was used to make sense of the arguments. This approach was chosen because it is well suited to the task of understanding and making sense of complex concepts and relationships (Milligan & Wood, 2010). Furthermore, it has the advantage of being able to draw on a wide range of disciplines, including philosophy and social sciences. The study began by identifying the key concepts in the argument. These were then defined, and the relationships between them were explored. The next step was to analyse the argument itself to identify its structure and how it was developed. Finally, the implications of the argument were considered in terms of its practical

applications. Overall, conceptual analysis proved useful because it allowed for a comprehensive understanding of the key concepts and helped clarify the structure of the arguments (Chalmers & Jackson, 2001). This was done by presenting a few methodological designs relevant to the transformative paradigm and arguing their relevance in implementing the paradigm.

Methodology of Transformative Paradigm

Transformative research aims to bring about social change (Dolejšová et al., 2021; Mertens, 2021). It is based on the belief that knowledge is power and that by producing and disseminating knowledge, society can be transformed for the better (Gambrell, 2016; Schulte et al., 2020). Transformative research is often conducted with marginalised groups to empower them and give them a voice. However, several different methodological designs can be used in transformative research. These include participatory research, participatory action research, community-based research, and arts-based research. Each of these approaches has its own tendencies, which makes the choice of the right methodology depend solely on the research's specific goals and objectives. However, all these approaches share a commitment to social change, and all involve working collaboratively with participants to co-produce knowledge (Devia et al., 2017; Foster, 2015; Macaulay et al., 1999). The study acknowledges that there may be many other designs, but this study will only consider participatory research design, participatory action research design, community-based research design, and arts-based research design. These approaches are discussed one after the other, and another section unpacked their transformative tendencies.

Participatory research

Participatory research is a research process that could also be referred to as a research design that actively involves all stakeholders in the research process from the planning to the implementation stage. This type of research is often used in community settings as it allows for a more collaborative and inclusive approach (Bergold & Thomas, 2012). Participatory research is commonly used in education and social sciences, where it was developed to engage all students in the learning process (Agbo, 2001; Van der Riet, 2008). In recent years, participatory research design has been increasingly used in healthcare settings as well and has been shown to be particularly effective in addressing complex health problems that require a multi-sectoral response (Andersson, 2018). It has also been used in environmental studies, social justice initiatives, and other fields (Robottom & Sauvé, 2003; Rosa et al., 2022). While there are many different fields of studies using this design, one common goal of the process is involving all stakeholders in the research process to create knowledge that is relevant and useful to the real-world context.

Proponents of participatory research argue that traditional research designs often fail to consider the lived experiences of those being studied. In contrast, participatory research is designed to be inclusive and collaborative, with an emphasis on equal partnership between researchers and participants. While there is no one-size-fits-all design for participatory research, a few common elements are typically included. These elements include: 1) co-creation of knowledge; 2) reflexivity; 3) reciprocity; 4) empowerment; 5) horizontal relationships; and 6) transformative potential. Based on these elements, when properly implemented, the participatory research approach has the potential to generate new insights and knowledge that can be used to improve the lives of those being studied.

Participatory Action Research

Participatory action research (PAR) is a research design that has been increasingly used in social science research. PAR involves involving participants in the research process

itself rather than simply using them as data sources (Jacobs, 2016). This allows for a more mutual and democratised relationship between researchers and participants, leading to more accurate and contextualised data (Kincheloe, 2009; Janes, 2016). There are several views to understanding PAR, but all views share a commitment to reflexivity, collaboration, and empowerment of the participants where both researchers and the *researched* share the same power of involvement (Ozano & Khatri, 2018; Ozer, 2017). PAR has been used in a wide range of social science disciplines, including education, sociology, anthropology, and community studies (Ackerly & True, 2019; Chitere & Mutiso, 2015; Mirra et al., 2015). While PAR has its critics, it has been shown to be an effective method for conducting research that is relevant to and informed by the experiences of participants (Yates & Leggett, 2016).

Another interesting thing about PAR is that it is an approach to research that draws on the knowledge and experiences of those who are most affected by the issue being studied. The aim is to produce research that is relevant and useful and involves and empowers participants. This design has since been adapted and applied in a range of settings, from community development to organisational change. However, proponents argue that PAR offers a more holistic and inclusive approach to research, which is particularly important in contexts where power relations are unequal (Felipe-Lucia et al., 2015). There is a growing body of literature on PAR, both in terms of methodology and application, and it has the potential to play a valuable role in social science research. That is, when used correctly, PAR can help to empower those who have been traditionally marginalised.

Community-based research

Community-based research (CBR) is also popular in social science research in recent years. CBR is defined as research conducted with and for communities, aiming to improve community wellbeing (Bischoff & Jany, 2018; Halseth et al., 2016). Proponents of CBR argue that it is a more ethical and participatory form of research than traditional methods, which often involve researchers working with the communities they are studying (Schinke & Blodgett, 2016). In addition, CBR has been shown to be an effective way to address social problems at the local level (Karmakar et al., 2017). For example, several studies have used CBR methods to successfully engage with hard-to-reach groups, such as homeless people and drug users (Franco et al., 2021; Mason et al., 2017). However, some critics have argued that CBR can be too reliant on the goodwill of community members and that it can be difficult to ensure the quality of data collected through participatory methods (Wilson et al., 2018).

Overall, though, CBR appears to offer a promising approach for social science researchers who wish to work in a more ethical and participatory way. This may be because it has a few advantages over traditional social science research methods. First, by involving community members in the research process, CBR can help to ensure that the research is relevant to the community's needs and interests (Bischoff & Jany, 2018). Second, CBR can help to build trust and relationships between researchers and the community (Grant et al., 2017). Finally, because CBR is conducted in partnership with community organisations, it can help to ensure that research findings are implemented in a way that is responsive to the community's needs (Halseth et al., 2016).

Arts-based research

Arts-based research (ABR) in social science research has grown in popularity in recent years as an approach to study social issues. The arts, including performance art, dance, visual art, and music, offer unique ways of understanding and representing social reality (Huss et al., 2015; Wang et al., 2017). Arts-based research methods can be used to study a wide range of topics, from individual experiences to large-scale social processes. ABR offers

several advantages for social science researchers. First, the arts can provide rich data sources that can be used to generate new insights into complex social phenomena (Leavy, 2020). Second, arts-based methods can help to engage participants in research processes in ways that are both enjoyable and informative (Greenwood, 2019). Third, the use of artistic expression can open new avenues for communication and collaboration among researchers and participants (Hannigan et al., 2016).

Despite the advantages of ABR in social science research, there are also some challenges associated with this approach. First, ABR methods can be time-consuming and resource intensive; second, the subjective nature of the arts can make it difficult to draw objective conclusions from research data and finally, the use of arts-based methods may not be appropriate for all types of research projects or all types of social science research questions. Overall, ABR offers a unique and powerful set of tools for studying complex social phenomena. When used appropriately, ABR methods can help researchers to generate new insights into the nature and workings of society.

Methodologies and their transformative Tendencies

This section discusses the suitability of the above-mentioned research methods and or designs. This is done to expose the reader to the transformative tendencies of PR, PAR, CBR and ABR. This is done under the following headings: Participatory research and its transformative tendencies, participatory action research and its transformative tendencies, community-based research and its transformative tendencies, and arts-based research and its transformative tendencies.

- **Participatory research and its transformative tendencies:** In order to implement a transformative paradigm, participatory research (PR) is one of the suitable research designs. As discussed above, the term ‘participatory’ refers to various forms of involvement in the research process by those individuals or groups who are the objects of the investigation. From the above discussion on PR, one could argue that there are three common goals of participatory research: first, to better understand social reality from the perspectives of those who experience it; second, to effect social change in favour of those groups; and third, to increase the capacity of individuals and groups to participate more fully in planning and decision-making processes that affect them. From these goals, PR is positioned to implement a transformative paradigm by giving power back to people and communities who have been traditionally marginalised. This could be implemented through different methods such as focus group discussion, rural appraisal, photovoice, and sharing of community experiences, among other methods. With these methods, PR has the potential to bring about structural changes in unequal power relationships, which transformative paradigms seek to deconstruct. Hence, PR has nevertheless shown great promise as a tool for implementing a transformative paradigm.
- **Participatory action research and its transformative tendencies:** Participatory action research (PAR) can implement a transformative research paradigm. Hence, PAR and the transformative research paradigm work hand in hand to dismantle power differentials toward making all-inclusive change and transforming the lives of the participants or the researched. This type of research is well suited to the transformative paradigm because it emphasises collaboration and social change. Like the transformative research process, it is also majorly directed toward solving an issue of social injustice towards making valuable change. Therefore, one can argue that the transformative potential of PAR lies in its ability to challenge power differentials and bring about all-inclusive change. This is achieved through the active involvement of participants in the research process and the sharing of power between researcher and

researched. The transformative potential of PAR has been recognised in a range of fields, including education, health, community development, and social work (Ackerly & True, 2019; Chitere & Mutiso, 2015; Mirra et al., 2015). Nevertheless, PAR provides a valuable resource for those interested in promoting all-inclusive change and transforming the lives of participants.

- Community-based research and its transformative tendencies:** Based on the above CBR conception, one can argue that community-based research (CBR) is a form of research that is conducted in partnership with community members. CBR has the potential to be transformative, meaning that it can lead to positive changes in the way that research is conducted, and how knowledge is produced. The relationship between CBR and the transformative paradigm is evident in the way that CBR emphasises community involvement, participatory methods, and social justice (Unertl et al., 2016). By involving community members in the research process, CBR ensures that research is relevant to the needs of the community and that findings are accessible to those who need them most, which is one of the propositions of the transformative paradigm. Therefore, CBR and transformative paradigm help to ensure that research results are used to improve the lives of community members. Another evidence interconnecting community-based research and transformative paradigm is their commitment to social justice means that it strives to address inequalities and promote positive change (Wallerstein et al., 2017). Together, these elements of CBR make it an ideal tool for implementing a transformative paradigm.
- Arts-based research and its transformative tendencies:** Based on the above ABR conception, one can argue that arts-based research is a methodology that uses artistic expression and creation to investigate a research question or topic. This type of research is also compatible with the transformative paradigm, which is concerned with social change and transformation. One of the reasons for this is that arts-based research often has the potential to be highly engaging and participatory, involving people in the research process in a way that is meaningful and potentially transformative. In addition, arts-based research often focuses on issues of social justice making it well suited to the goals of the transformative paradigm. Another advantage of arts-based research is that it can provide insights and perspectives that are not always accessible through more traditional methods. For all these reasons, arts-based research is an important methodological approach for researchers working within the transformative paradigm.

Conclusion and Recommendation

This study has argued the need for research to make use of appropriate methodological processes when conducting research within the lens of a transformative research worldview. The study further provides an answer to the research question on the appropriate methods and/or research designs for implementing a transformative research paradigm in research. Therefore, the study concluded that participatory research as a research design, participatory action research as a research design, community-based research as a research design and art-based research as a research design are some of the research designs that could be used to implement studies under the transformative worldview. All these methods have in common the potential to bring about social change by providing opportunities for people to reflect on and change their current ways of living. These designs were deemed appropriate because they would allow for an equal power relationship between researcher and participants, emphasise collective action, and aim to bring about social change. Consequently, these designs match well with the aims of transformative research and should be considered as such. However, the study is not without limitation, and the limitation is that the researcher recognises that there

may be many other relevant research designs that could be used to implement transformative research and hence could be traced in further studies.

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EXPLORING OCCUPATIONAL GUIDANCE, ENTREPRENEURSHIP EDUCATION AND ECONOMIC EMPOWERMENT AMONG RURAL WOMEN

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Abstract

This study sought to investigate occupational guidance, entrepreneurship education and economic empowerment among rural women with children in Owerri Education Zone of Imo State, Nigeria. The study adopted a descriptive survey research design. The researchers sampled 800 rural women using a multi-stage sampling technique. A self-report scale was used in the study. The internal consistencies of 0.91, 0.90 and 0.92 for the three clusters were ascertained using Cronbach Alpha. Data was collected from each of the sampled areas using questionnaires to elicit responses from the participants. The data collected from the participants were analyzed using descriptive statistics. The findings showed that the occupational guidance obtained by women in the rural area include training on how to produce cake, and orientation on personal-social skills to remain in occupation. Vocational counselling helped women to know occupations, workshop, career seminar, and occupational guidance programme that make women develop a business mindset and among others. This result revealed that the entrepreneurship education available for women in rural area include marketing skills, poultry skill, starch production skill, and the production of local toy materials. The findings also found that the Structural Adjustment Programmes (SAP), Operation Feed the Nation, Imo State skill acquisition training scheme, Imo State farmers' cooperatives, and Imo state community revolving loan schemes are economic empowerment schemes for rural areas. Therefore, we recommended professional counsellors should engage rural women by organising seminars and workshops on entrepreneurship education and economic empowerment.

Keywords: Occupational guidance, Entrepreneurship education, Economic empowerment, rural women

Introduction

It is worrisome that rural Nigerian women have been relegated to the background in most national issues like education, politics and economic empowerment (Opara, 2019). Despite the international economic empowerment programme initiatives and policies designed for rural women and the introduction of career education and entrepreneurship education into the National Policy on Education, rural women still constitute 70% of the 20 million of the world's poorest people (Opara, 2019). Past studies showed the potential of women in rural locations has not been harnessed and a large number of them are still poor (Opera, 2019). They are endowed with the potential (e.g., business skills) and capacities (e.g., resilience) to develop into fully functional individuals in their environment through nature. Sometimes people need assistance since the profession they chose does not accurately reflect their personality and psychological makeup (Ede et al., 2019). There is a need for vocational counselling and information in order for them to actualize or effectively utilize these inherent endowments. By doing this, occupational maladjustment will be less likely.

To prevent the prevalence of occupational maladjustment, educationists (e.g., Akinlua, 2007; Ibukun & Aboluwodi, 2010) continually call for reform and repositioning of the system of education in Nigeria owing to the fact that the Nigerian system of education seems bookish. This circumstance had a significant impact on the National Policy on Education (NPE) as many graduates could not practice what they have studied. Which now views entrepreneurship as a potential remedy for the nation's deepening economic slump. Due to this, entrepreneurship has gained notoriety as a means of employment creation and empowerment for young people and women who are out of work (Chigunta, 2001; Ede, 2014; Okoh, 2015).

Although rural women have been exposed to income-generating schemes, and entrepreneurial-oriented awareness programmes to mobilize them for group action (Odejimi & Agbada, 2014), there is a persistent increase in poverty among rural women (Odejimi & Agbada, 2014). Given these, the present researchers are not sure about the nature of entrepreneurship education available in rural women, the type of occupational guidance obtained, and the current state of economic empowerment existing in rural locations especially in Imo state Nigeria (Eze, 2010; Opera 2019). We argued that if there is adequate entrepreneurship education, occupational guidance, and economic empowerment, there would not be high unemployment rates among women in Nigeria. In the labour force (active and willing to work 16–64 years old) during the third quarter of 2018, 26.6% of women were unemployed (Salau 2019). The result is 6.5 percentage points higher than the unemployment rate for the entire labour force, which is 23.1%, and 6.3 percentage points higher than the rate for men, 20.3% (Salau 2019). This reflects a 5.4 percentage point increase in the unemployment rate for women compared to the same time last year. In addition, 25.9% of women in the labour force were underemployed, which is a 4.1 percentage point rise from the year before (Salau 2019).

Consequently, women's entrepreneurial competence is a crucial tool and gauge for the development and change of the country (Eduwen, 2015). Ikechi and Edward (2009) argued that providing women with entrepreneurship education serves as a valuable tool for generating income, increasing productivity through innovation, facilitating the transfer of technology, playing a crucial role in the commercialization of new products, wealth redistribution, and promoting social welfare. However, there is a misperception that rural residents and the underprivileged in developing nations like Nigeria are not suited for entrepreneurship (Nwadiani, 2011). Efe (2014) supports the idea that these false assumptions work against the acceptability and popularization of entrepreneurship in the formulation and implementation of educational policy in Nigeria. However, it is unknown who teaches rural women how to start their own businesses (Sha & Saurabh, 2015).

Despite the aforementioned premises, the need for entrepreneurial education for lower the high unemployment and poverty rates among rural women in Nigeria is still stressed (Efe, 2014). Rural women may significantly contribute to the rural economy in all regions of the world through their entrepreneurial abilities, according to the Food and Agriculture Organization of the United Nations (FAO, 2010). Studies have deplored that compared to their urban counterparts, rural women's participation in the economically active population is significantly lower (Cliche, 2011; World Bank, 2007). Although rural women play a significant role in agriculture and rural activities, FAO (2010) is concerned that higher barriers to education and training prevent them from engaging in more lucrative and productive work. Due to their disadvantaged upbringing, rural women's hindrances appear to be lack of career guidance, counseling, and education. Rural women are typically denied equal access to information, technical know-how, extension programs, entrepreneurial training, marketing assistance, credit, and a general opening up of their horizons in most

developing nations, including Nigeria, Bangladesh, India, Pakistan, and Sri Lanka, to name a few (Sha & Saurabh, 2015).

Women can be empowered by utilizing a variety of tactics. As part of initiatives to increase women's empowerment, education, economic resources, and women's health need to be given top emphasis (Kongolo & Bamgose, 2002). According to UNRISD (2010), methods are needed to empower women, including education, raising the proportion of women in national parliaments, combating violence against women, eradicating gender inequality, reducing women's dependency on informal empowerment, and ensuring sexual health. Evidence suggests that a lack of entrepreneurial education and career advice are the primary causes of failure (Eze et al 2017). However, a past study has found that, in contrast to their urban counterparts, rural women lack equitable access to information, technical know-how, extension programs, and training (Chen et al. 2019). Consequently, they rarely participate in national economic development since their special needs and priorities are neglected. The negative impacts of these neglects, relegation and lack of occupational guidance as well as entrepreneurship education on income generation of rural women and national economic development and growth cannot be overemphasized. In addition, the strategies put in place to empower Nigeria rural women's economic growth through the auspices of occupational guidance counsellors and entrepreneurship educators seem to have failed.

The introduction of vocational subjects and entrepreneurial skills in Nigerian schools is expected to change the perceptions and attitudes of rural women towards occupational guidance and entrepreneurship education. To invest in the current situation in rural areas becomes imperative and timely. With this in mind, the researchers are poised to ask; what are occupational guidance, entrepreneurship education and economic empowerment among rural women?

Purpose of the Study

The general purpose of this study is to explore occupational guidance, entrepreneurship education and economic empowerment among rural women in Owerri Education Zone of Imo State Nigeria

Specific purposes include:

1. To explore the occupational guidance obtained by women in rural areas in Owerri Education Zone of Imo State
2. To explore the entrepreneurship education available to rural women in Owerri Education Zone of Imo State
3. To explore the state of economic empowerment of rural area in Owerri Education zone

Research Questions

1. What are the occupational guidance obtained by rural women in Owerri Education Zone of Imo State?
2. What are entrepreneurship education available to rural women in Owerri Education Zone of Imo State?
3. What is the state of economic empowerment of rural areas in Owerri Education zone?

Methods

Research Design

This study adopted a descriptive survey research design. This is considered suitable because the researchers collected data from the representatives of the population and described systematically the rural women's responses on occupational guidance, entrepreneurship education and economic empowerment in Owerri Education Zone of Imo State Nigeria

Area of the Study

The area of the study was Owerri Education Zone of Imo state. Owerri is one of the Education zones of Imo state. This Education Zone has nine Local Government Areas comprising Mibaitoli, Ezimilitte Mbaise, Ahiazu Mbase, Aboh Mbaise, Ikeduru, Owerri North, Owerri Municipals, Owerri West and Ngor-Okpala. The northern part of Owerri Education Zone is bounded by Anambra state, the southern part is bounded by River state the eastern part is Abia State while western part is bounded by Oguta. The female inhabitants of Owerri North are businesswomen but predominantly farmers. The choice of this area is based on the observed poverty rate, unemployment rates, and poor attitude towards entrepreneurship. In addition, the high rate of housewives necessitated this area of study.

Participants

A total of 800 rural women made up the study's sample size. For this investigation, a multi-stage sampling technique was used. First, using the purposive sample technique, four local government areas were chosen. The local government areas were selected because they belong to rural areas. Second, eight communities were chosen from the four local government areas using the proportionate sample technique. The researchers used proportionate sample techniques because in each local government, equal percentage of the respondents were selected, in that two communities were selected from each Local Government. Thirdly, 100 female participants were chosen at random from each of the eight villages (i.e., $100 \times 8 = 800$), using basic random selection. This is a simple random sampling technique without replacement. It is a situation whereby there were cuts-out-cards put in a bowl and the participants were asked to pick. This was done to give them the chance of being selected. The process was conducted during the women's general annual meeting.

Instrument

The instrument for data collection was a structured questionnaire designed by the researchers titled: Occupational Guidance and Entrepreneurship for Rural Women's Economic Empowerment Questionnaire (OGERWEEQ). This questionnaire has part A and B. The respondents' personal information is the main topic of Section A while Part B contains 43 items. The 43-item self-report is grouped into Clusters 1, 2, and 3, accordingly. Information about the occupational guidance received by women in rural areas is elicited in Cluster 1. Cluster 2 focuses on entrepreneurship education offered in rural areas. Cluster 3 focuses on rural women's state of economic empowerment. The questionnaire items are placed on a four-point rating scale of Strongly Agree=4, Agree=3, Disagree=2, and Strongly Disagree=1. The items that are negatively skewed were reversely scored. The instrument was face validated by experts in Guidance and Counseling, Department of Educational Foundations, University of Nigeria, trial-tested, and used the result of the trial test to do the reliability test. The results of the Cronbach Alpha method were 0.91, 0.90, and 0.92 for the three clusters indicating that the instrument was reliable to be used for this study.

Method of Data Collection

With the aid of two research assistants, the researchers personally administered the questionnaire to the respondents. The research team gave them a briefing on the procedures for using the instrument and how to get data. Utilizing research assistants improved how copies of the instrument are distributed and retrieved. To ensure a high rate of instrument return, the instrument were administered and retrieved immediately.

Data Analysis

The data collected was analyzed in line with the research questions postulated. Descriptive statistics (Mean, Standard Deviation) were used to answer research questions 1, 2 and 3, respectively. The set criterion mean of 2.50 was used as a benchmark for research questions 1 to 3.

Results

Research Question One: What are the occupational guidance obtained by rural women in Owerri Education Zone of Imo State?

Table 1. Mean and standard deviation of the occupational guidance obtained by rural women in Owerri Education Zone of Imo State

| S/N | Items on the occupational guidance obtained by women in rural area | n=800 | | |
|--|---|-------------|-------------|----------|
| | | Mean | SD | RMK |
| 1 | I have received occupational guidance on how to produce cakes from career counsellors | 3.50 | 0.83 | A |
| 2 | I been oriented with personal-social skills to remain in occupation | 3.39 | 0.68 | A |
| 3 | Career education I received has helped me to know available opportunities in the world of work | 3.50 | 0.69 | A |
| 4 | Vocational education prepared me to choose an occupation based on my abilities | 3.39 | 0.82 | A |
| 5 | I have not obtained insight to critically examine occupational characteristics | 3.13 | 1.02 | A |
| 6 | Career programmes available in Nigeria Television authority have enlightened me on my intended occupation | 3.06 | 1.08 | A |
| 7 | I received occupational guidance through counsellors | 2.55 | 1.07 | A |
| 8 | Occupational guidance has not exposed me to consider my interest before choosing a career | 2.67 | 1.16 | A |
| 9 | Career day helps me to get information on the occupation | 2.84 | 1.02 | A |
| 10 | Occupational guidance programme I participated in made me develop a business mindset | 3.34 | 0.78 | A |
| 11 | Occupation information guides one to have a clear understanding of self before entering into a business | 3.33 | 0.75 | A |
| 12 | Individual vocational counselling has exposed me to occupations that I did not know before | 3.28 | 0.65 | A |
| 13 | I have attended workshops as an occupational guidance | 2.72 | 0.94 | A |
| 14 | I have participated in career seminars in my village | 3.22 | 0.98 | A |
| 15 | It provides fundamental knowledge about an existing opportunity | 2.39 | 1.06 | D |
| Total Mean and Standard Deviation | | 3.09 | 0.42 | A |

Keys: n= sample; SD=Standard Deviation; A=Agree

Data analysis presented in Table 1 shows the mean and standard deviation of the occupational guidance obtained by rural women. The analysis shows that the mean score of items 1 to 14 are 2.55 and above with the overall mean score and standard deviation (3.09 ± 0.42), meaning that the participants agreed that items 1 to 14 are occupational guidance obtained by rural women in Owerri Education Zone of Imo State. It was only item 15 that was below 2.55, indicating that the respondents do not agree occupational guidance provides fundamental knowledge about an existing opportunity. This reveals that the occupational guidance obtained by rural women in Owerri Education Zone of Imo State include training on how to produce cake, orientation on personal-social skills to remain in occupation, career education to know available opportunities in world of work, vocational education for choosing occupation based on abilities, insight to critically examine occupational characteristics, enlightenment for career programmes available in Nigeria Television authority, occupational guidance through counsellors, occupational guidance on how to consider my interest before

choosing a career, career day helps to get information on occupation ; it provide fundamental knowledge about a existing opportunity, occupation information guides one to have clear understanding of self before entering into a business, individual vocational counselling has exposed one to occupations, workshop, career seminar, and occupational guidance programme makes one develop business mindset.

Research Question 2: What are entrepreneurship education available to rural women in Owerri Education Zone of Imo State?

Table 2: mean and standard deviation of the entrepreneurship education available to rural women in Owerri Education Zone of Imo State

| S/N | Items on entrepreneurship education available in rural areas | n=800 | | |
|--|--|-------|------|-----|
| | | Mean | SD | RMK |
| 1 | Entrepreneurship education that supports marketing skills is available in my local area | 3.34 | 0.67 | A |
| 2 | Introduced of starch production skills in my community by Government has added to my entrepreneurial knowledge | 2.95 | 0.97 | A |
| 3 | Production of household decorative materials is available in my village | 2.84 | 1.02 | A |
| 4 | There is no SURE-P programme in my villages such as tie and dye skill | 2.67 | 1.06 | A |
| 5 | I have received education on home management as a business skill | 2.99 | 1.02 | A |
| 6 | Production of local toy materials is not part of entrepreneurial skills in the community | 2.67 | 1.06 | A |
| 7 | I do not have orientation on the production of chinchin | 2.55 | 0.96 | A |
| 8 | My people have not been exposed to Fish farming | 2.78 | 0.92 | A |
| 9 | There is Government-owned entrepreneurship center to train rural women in hairdressing skill | 3.23 | 0.63 | A |
| 10 | Production of doughnut | 2.73 | 0.99 | A |
| 11 | Soap-making opportunities are not obtainable due to a lack of career orientation | 2.56 | 1.12 | A |
| 12 | I have received entrepreneurial education on catering as a business skill | 2.33 | 0.67 | D |
| 13 | Entrepreneurial education has enhanced my business skills | 2.28 | 0.65 | D |
| 14 | Beekeeping skills are currently available in my village | 2.33 | 1.06 | D |
| 15 | My community has excluded regional mainstream economies like braiding production | 2.11 | 0.81 | D |
| 16 | I do not have access to learn poultry skill | 2.39 | 0.96 | D |
| Total Mean and Standard Deviation | | 2.67 | 0.39 | A |

Keys: n= sample; SD=Standard Deviation; A=Agree; D=Disagree

Data analysis presented in Table 2 shows the mean and standard deviation of the entrepreneurship education available to rural women in Owerri Education Zone of Imo State. The analysis shows that the mean score of items 1 to 11 is 2.55 and above, with the overall mean score and standard deviation (2.67±0.39). This means that the entrepreneurship education available to rural women in Owerri Education Zone of Imo State include marketing skills, poultry skill, starch production skill, production of local toy materials, orientation on the production of chinchin, production of doughnut, production of household decorative materials. There is no entrepreneurship education on soap-making opportunities, Beekeeping skills, and there is no Sure-P programme in most villages such as tie and dye skills, government has not made efforts to train rural women in hairdressing skills, braiding production, and fish farming.

Research Question 3: What is the state of economic empowerment of rural women in Owerri Education zone?

Table 3: mean and standard deviation of the state of economic empowerment of rural women in Owerri Education zone

| S/N | Items on the state economic empowerment of rural women | n=800 | | |
|--|--|-------|------|-----|
| | | Mean | SD | RMK |
| 1 | There is micro-credit schemes for rural women as a group to improve their economic empowerment | 2.28 | 1.10 | D |
| 2 | Structural Adjustment Programmes (SAP) is Imo state economic scheme for rural women | 2.62 | 0.95 | A |
| 3 | Operation Feed the Nation is part of Imo state initiatives | 2.84 | 0.96 | A |
| 4 | Imo State skill acquisition training centre for rural women | 2.44 | 0.96 | D |
| 5 | Better life for rural women is an Imo State programme | 2.67 | 1.11 | A |
| 6 | Information about economic investment opportunities | 2.55 | 0.84 | A |
| 7 | poverty alleviation is a part of state economic empowerment in my State | 3.17 | 0.84 | A |
| 8 | Educating rural women about means of removing gender inequality toward economic empowerment | 2.94 | 0.85 | A |
| 9 | The government built rural storage facilities in my community as an economic empowerment | 2.44 | 0.96 | D |
| 10 | There is enterprise development training as financial empowerment in my state | 2.56 | 0.84 | A |
| 11 | Investing in infrastructure to reduce rural women's financial burden | 2.67 | 1.06 | A |
| 12 | Imo State farmers' cooperatives are very active state economic programme in my local area | 2.78 | 0.92 | A |
| 13 | Imo state community revolving loan schemes | 2.51 | 1.07 | A |
| Total Mean and Standard Deviation | | 2.65 | 0.31 | A |

Keys: n= sample; SD=Standard Deviation; A=Agree; D=Disagree

The data analysis presented in Table 3 shows the mean and standard deviation of the occupational guidance obtained by women in rural area. The analysis shows that the mean score of items 2, 3, 5, 6, 7, 8, 10 to 13 are between 2.51 to 2.94. While items 1, 4 and 9 had mean scores of 2.28, 2.44 and 2.44 with standard deviations of 1.10, 1.96 and 1.96, respectively. However, the overall mean score and standard deviation (2.65±0.31). This means that the economic empowerment scheme for rural areas in Owerri Education Zone of Imo State includes Structural Adjustment Programmes (SAP), Operation Feed the Nation is part of Imo state initiatives, Imo State skill acquisition training centre for rural women, information about economic investment opportunities, poverty alleviation is a part of state economic empowerment, educating rural women about means of removing gender inequality towards economic empowerment, enterprise development training as financial empowerment, investing in infrastructure to reduce rural women financial burden, Imo State farmers' cooperatives, and Imo state community revolving loan schemes. On the other hand, the rural women disagree that there are micro-credit schemes for rural women as a group to improve their economic empowerment, a better life for rural women is an Imo State's programme, and the government built rural storage facilities in communities as economic empowerment.

Discussion of the Results

The occupational guidance obtained by women in a rural area in Owerri Education Zone of Imo State.

The result revealed that the occupational guidance obtained by women in a rural area in Owerri Education Zone of Imo State includes training on how to produce a cake, orientation on personal-social skills, career education to know available opportunities in the world of work, vocational education for choosing occupation based on abilities, insight to critically examine occupational characteristics, and enlightenment for career programmes available in Nigeria Television authority. Others include occupational guidance through counsellors, occupational guidance on how to consider interest before choosing a career, career day helps to get information on occupation, it provides fundamental knowledge about an existing opportunity, occupation information guides one to have a clear understanding of

self before entering into a business, Individual vocational counselling has exposed one to occupations, workshop, career seminar, and occupational guidance programme makes one develop a business mindset. The result appears interesting as the rural women receive occupational guidance in spite of the fact that they live in rural areas. It is, therefore, possible that as rural women are being exposed to occupational guidance, the level of occupational maladjustment would continue to reduce drastically. This is in line with Ede (2014), who revealed that vocational counselling is being given to rural and urban people's value orientation towards entrepreneurial skills acquisition is positive. The result of the present study agreed with Ugwoke, Ibe and Muhammed (2013), who showed that conferences, seminars, workshops, professional lectures, and teacher meetings are the staff development programmes that are prevalent for teacher's capacity building. Buttressing the relevance of occupational guidance, Eze (2010) revealed that the choice of career is influenced by career education, irrespective of location.

It was found that the occupational guidance obtained by women in a rural area in Owerri Education Zone of Imo State includes training on how to produce a cake, orientation on personal-social skills, career education, vocational education for choosing occupation based on abilities, insight to critically examine occupational characteristics, enlightenment for career programmes, occupational guidance through counsellors, consideration of interest before choosing a career, provides fundamental knowledge about an existing opportunity, occupation information guides one to have a clear understanding of self before entering into a business, Individual vocational counselling has exposed one to occupations, workshop, career seminar, and occupational guidance programme makes one develop a business mindset. The implication is that skill acquisitions are being propagated through vocational guidance. It also implies that many women will not be maladjusted due to a lack of vocational guidance in the Imo state.

The entrepreneurship education of rural women in Owerri Education Zone of Imo State

The results shows that the entrepreneurship education available for women in a rural area in Owerri Education Zone of Imo State include marketing skills, poultry skill, production skill such as starch, local toy materials, chinchin, doughnut, and making household decorative materials. There is no entrepreneurship education on soap-making opportunities, Beekeeping skills, and there is no sure- programme in most villages, such as tie and dye skills, government has not made efforts to train rural women in hairdressing skills, braiding production, and fish farming. The availability of marketing skills, poultry skills, and production skills such as starch, local toy materials, chinchin, doughnut, and making household decorative materials is an indication that the economy of the rural women in Imo State may sustain their livelihood. This implies that their family income is likely stable. This is interesting because the rural women in Imo State may not like to engage in social vices in their local areas. This is not surprising as those women appear busy in their businesses. Consequently, there is enough food in the local area and they are not counting lack of employment as a challenge. This agrees with Anyadike, Emeh and Ukah (2012), who revealed that the prospect of entrepreneurship development generates employment. This is remarkable as they are self-reliant, happy, and reduced the poverty expectancy in the rural areas of Imo State. The finding also concur with Obunadike (2013) who revealed that entrepreneurship education helps to be competitive, have the acumen to manage their own business, business oriented, reduce dependence on white collar jobs, take risks in business help in problem-solving, help them in poverty alleviation and gainfully employed. The result of the current study also supports Mustapha, Umaru and Muhammad (2015), who showed that students agreed generally that the training programme impacted positively on a different aspect of their entrepreneurship skills by making what is learnt in the programme more

meaningful. In the same vein, Ikeme (1996) revealed that most students indicated a high interest in Agriculture. Similarly, Anyadike, Emeh and Ukah (2012) revealed that the opportunities entrepreneurship creates economic growth and development as well as constraints and difficulties in their operating environment.

In addition, the results suggest that there is no entrepreneurship education on soap making opportunities, Beekeeping skills, and there is no sure-p programme in the villages such as tie and dye skills, the government has not made efforts to train rural women in hairdressing skills, braiding production, and fish farming. This is not in line with Gyanfi (2014) revealed that most entrepreneurship graduates establish their own business ventures.

The state of economic empowerment of rural women in Owerri Education Zone of Imo State

The result reveals that the economic empowerment scheme for rural areas in Owerri Education Zone of Imo State includes Structural Adjustment Programmes (SAP), Operation Feed the Nation is part of Imo state initiatives, Imo State skill acquisition training centre for rural women, information about economic investment opportunities, and poverty alleviation is a part of state economic empowerment. Others are educating rural women about means of removing gender inequality towards economic empowerment, enterprise development training as financial empowerment, investing in infrastructure to reduce rural women's financial burden, Imo State farmers' cooperatives, and Imo state community revolving loan schemes. The economic empowerment schemes being provided to rural women in Imo State appeared commending because anybody who is a preview and beneficiary of those empowerment initiatives is likely to be resourceful. The result suggests possible rapid growth of the economy in rural areas of Imo State. It is, therefore, possible that if the scheme continues, the women in rural areas will be contributing a considerable percentage to the national economy. This agrees with Stella (2015) who revealed that entrepreneurship education is very vital for national economic development. This is in agreement with Anyadike, Emeh and Ukah (2012) who revealed that the opportunities entrepreneurship creates economic growth and development as well as constraints and difficulties in their operating environment. This is interesting as Ugwoke, Ibe and Muhammed (2013) showed that conferences, seminars, workshops, professional lectures, and teachers' meetings are the staff development programmes that are prevalent for teachers' capacity building.

On the other hand, the results of this study also suggest that rural women disagree that micro-credit schemes for rural women, a better life for rural women is an Imo State programme, and the government built rural storage facilities in the community as economic empowerment. The result is quite disappointing that despite the efforts of rural women to become economically independent, there is still no aid fund available for rural women to support them. By indication, those schemes may not have economic long-term impacts on the source of livelihood among the rural women in Imo State. This disagrees with Kabir, Hou, Akther, Wang and Wang (2012) who showed that the role of NGOs micro-credit and training program has a great impact on entrepreneurs' livelihood patterns and developed living standards. Ofoha (2011) revealed that sampled students had learnt significant self-employable entrepreneurial skills in 6 out of 36 vocational areas. The implication is that the Imo state government is making an economic-driven policy that would empower women in the state. It also implies that the government is bridging the gap between the poor and rich through economic empowerment schemes.

Conclusions

The study concluded that occupational guidance obtained by women in the rural area includes training on how to produce cake, and orientation on personal-social skills to remain

in occupation. Vocational counselling helped women to know occupations, workshops, career seminar, and occupational guidance programmes that make women develop a business mindset and among others. This result revealed that the entrepreneurship education available for women in rural area include marketing skills, poultry skill, starch production skill, and production of local toy materials. The findings also found that the Structural Adjustment Programmes (SAP), Operation Feed the Nation, Imo State skill acquisition training scheme, Imo State farmers' cooperatives, and Imo state community revolving loan schemes are economic empowerment schemes for rural areas.

Recommendations

The following recommendations were made based on the findings of this study and consequent education implications.

Professional bodies like the Council of Nigeria and Counselling Association of Nigeria should hold national conferences with particular emphasis on vocational guidance, entrepreneurship education, and economic empowerment of rural women. If counsellors are adequately prepared with all the tools needed, assistance from government and organisations should follow to ensure compliance and good practice that will encourage and promote women's entrepreneurial skill acquisition and empowerment. Government should continue to make high-powered vocational guidance and entrepreneurial skill acquisition programmes for economic sustainability.

Limitations

The researchers noticed various limitations when doing this investigation. Only rural women were involved in this study, and this perpetuated gender norms. This might prevent the finding from being applied to a larger population. The study's design might not have exposed the researchers to a rigorous scientific method of inquiry. The researchers would have completely addressed the drawback of a descriptive survey approach if they had employed a randomized or non-randomized control trial design. They might have had an impact on the outcomes, limiting the findings' capacity to be generalized. The generalizability of the finding to a larger population seemed to have been constrained by the use of only one instrument. Therefore, we recommend that future studies should strengthen subsequent investigations to eliminate these methodological flaws.

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TEACHING STRATEGIES AS TOOL FOR TRAINING SKILLED SOCIAL SCIENCE EDUCATION TEACHERS IN NIGERIA

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Abstract

This study investigated the application of group discussion, island hopping, plenary session, case study and scenario building teaching strategies to inculcate teaching skills in Social Science Education teacher trainees. The objectives of the study include exposing teacher trainees to these teaching strategies to determine their efficacies and inculcate in them the skills to apply them during teaching and learning. One hundred and thirty-five Social Science education teacher trainees were exposed to the five teaching strategies for a semester. At the end of the semester, they were given feedback slips individually to comment freely on how they perceived the teaching strategies. Contextual research design was used for the study. Data collected from feedback slips were analysed using content analysis and findings were presented using frequencies and percentages. The findings of the study showed that the teaching strategies are interesting, interactive, participatory, experiential, and capable of inculcating teaching skills such as critical thinking, and communication skill among others. Based on the findings, it was recommended that university authorities should encourage lecturers to use these teaching strategies during teaching and learning.

Keywords: Case study, group discussion, island hopping, participatory, plenary session, scenario building

Introduction

The importance of teacher education for quality teachers cannot be overemphasized. To become a teacher in Nigeria, one should pass through the teacher education programme. The teaching skill of a teacher in delivering quality education is dependent on the effective application of teaching strategies possessed by the teacher. Teaching strategies can be acquired during teacher training programme. Teacher education refers to the policies, procedures and provisions designed to equip prospective teacher trainees with the knowledge, attitudes, behaviours and skills they require to perform their tasks effectively in the classroom, school and community (Taylor, 2018). Teacher education programme can be seen as a training programme which provides the prerequisite knowledge and skills required of a professional teacher. It is a systematically designed education programmes for preparing individuals for the teaching profession. To acquire the competencies required in teaching, teacher trainees should be given adequate training before commencing work (Sisman & Acat, 2003).

Teacher training programme known as teacher education in Nigeria is provided by Faculties and Institutes of Education in the Universities, Universities of Education, Colleges of Education and National Teachers' Institute among others. Federal Republic of Nigeria (2013, p.30) stated that "all teachers in educational institutions shall be professionally trained". It highlighted the goals of teacher education in Nigeria to include, producing highly motivated, conscientious and efficient classroom teachers for all levels of the educational system; encouraging the spirit of enquiry and creativity in teachers; enhancing the commitment to national goals; providing teachers with the intellectual and professional

background adequate for assignment and to make them adaptable to changing situation, and enhance teachers' commitment to the teaching profession. Oddens (2004) further said that to provide effective and self-regulating instruction in a rich learning environment, student teachers should be trained in teaching strategies and approaches. Hence, this study examined teaching strategies as a tool for training skilled Social Science Educations students at the University of Nigeria.

Teaching strategies are plans of action designed to achieve learning objectives. Teaching strategies encompass teaching methods and techniques designed to achieve the overall aim of the lesson (Chun, 2010). Teaching strategies make the teacher act as learner support who manipulates and stimulates learners, making them active participants and solution finders to problems supported with planned teaching aids and well-made notes to guide the process (Chukwu & Chukwu, 2008). When students are properly engaged, they learn more and retain more (Davis, 2017).

This study focused on five innovative teaching strategies. They include group discussion, island hopping, plenary session, case study and scenario building. The study focused on these teaching strategies because they would effectively engage students in classroom activities. It makes teaching and learning easy and interesting, it encourages problem solving skills, teamwork and collaboration. Chun (2010) posited that teaching strategies enable students to work with peers in collaborative groups to showcase their learning. With the above-mentioned teaching strategies, students will be active rather than passive learners. Group discussion teaching strategy is a process whereby the teacher divides students into convenient groups, assign them tasks and asks group members to discuss among themselves and find a solution. It entails every member making contribution to the task, rather than the discussion being monopolised by an individual. Group discussion is an activity in which a small number of persons meet face to face, exchange and share ideas freely or attempt to decide on a common issue (Kukreja, 2018). The author pointed out that group discussion is a creative and dynamic activity which stimulates reflective thinking among members. Group discussion provides students opportunities to work in different contexts and provides lecturers opportunities to observe students in different situations. Albemarle (2018) observed that if group discussion is used effectively, it facilitates students' social development and provides opportunities for students to develop an understanding of their strengths and weaknesses related to a specific task or assignment while developing strategies for strengthening their weaknesses through peer modelling and assistance. Group discussion encourages cross-fertilization of ideas among group members. Catapano (2018) observed that when students can verbalize their ideas, listen to one another, share authentic discussions, and create common products, they are much more actively engaged in the learning process. New Delhi (2015, June 20) pointed out that group discussion has a lot of advantages such as, helps to overcome shyness in students and brings his/her viewpoint amidst all, stimulating them to think in a different new way, helping student in understanding his/her strengths and weaknesses, acts as an aid in the expansion of knowledge of students and helps to analyse social or economic issues more logically.

In the group discussion, the lecturer needs to decide on the issues or concepts to be discussed, allocate different concepts or issues to each group or give the same topic to every group to deliberate on. Students can be grouped in twos, threes, fives and so on. They can be grouped by assigning the alphabets "A" to "E" to students and asking all "As" to form a group, "Bs" and so on. It is important to note that group leaders should not be monopolized, in other words, group leadership should be rotational. The next teaching strategy to be discussed is island hopping.

Island hopping is a kind of icebreaking activity which the lecturer uses at the beginning of the semester as an introductory exercise to present an overview of the course, and to

encourage students to focus and work together as a team. Nottingham Trent University, (2018, March 30) submitted that icebreaking activities are short exercises used to help students know little about one another and also intended to encourage students to work with one another on a task. Island hopping is an icebreaking activity linked to the course as it is used to introduce major concepts and issues in a particular course of study. In this context, the “island” is not the traditional island as commonly known rather, educational concepts and issues are embedded in the course. The lecturer identifies the concepts and issues from course contents, extracts about seven of them, get cardboard sheets to number them one to seven and then writes the identified concepts or issues each on a cardboard sheet (it is pertinent to note that the number of issues selected should not be cumbersome to avoid monotony). The lecturer guides students to develop an itinerary with which to access the “islands” by asking them to write numbers one to seven in a scattered format (not in ascending or descending order) on a small sheet of paper. The lecturer places the cardboard sheets (that is the islands) far apart from each other on the floor or pastes them on the walls of the classroom. The lecturer educate students on the rules of the exercise which include, dropping all bags and writing materials when going to the island, taking the itinerary which is the route to the island, accessing the islands with the numbers on the itinerary, counting from left to right, the first number on the itinerary from the left, becomes the first island to visit, followed by the next number until all numbers or islands are visited. When they get to their islands, they would meet other adventurers (students) on the island whose first numbers on their itinerary are the same, they would exchange pleasantries, look at the issue on the island and deliberate on it. The rule of the discussion is that no individual should monopolise the discussion and every member of the group must contribute. The lecturer gives them three to five minutes to deliberate on the issue, after which he/she claps hands or rings the bell for participants to leave the present island and move to the next. As they are discussing, the lecturer moves from one island to the other to encourage and guide the students. This exercise will continue until each student has visited the seven islands. At the end of the exercise, students can go back to their seats or stand circularly while the lecturer asks them about the lessons learnt from the activity. It is pertinent to note that this exercise can be done in a lecture room if it is spacious enough, or any spacious clean environment close to the lecture room or school field. Chukwu (2015) observed that island hopping helps to harness students' focus and make them relaxed and comfortable with the course. Island hopping teaching strategy encourages teamwork, collaboration, socialization among students and an engaging study style. The next teaching strategy to discuss is scenario building.

Scenario building strategy helps teacher trainees to apply concepts to a realistic situation which increases the likelihood of remembering concepts. Scenario building teaching strategy is a kind of brainstorming exercise in which students are given the opportunity to apply what they have learnt to realistic situations (Kelly, 2015; Orr, 2018). With this teaching strategy, teacher trainees are not only exposed to relating concepts to real situations but also acquire the skill of using this strategy to teach when they eventually go into the teaching profession. The activity involves deciding on what concepts, issues or models the lecturer wants students to work on. For instance, if a lecturer is taking a topic like “family”, he or she can cut out pictures of husband, wife and children; husband, wife, children, uncles, aunt, niece, nephew and so on, paste them vertically on the left-hand side of the cardboard sheet. Leaving enough gap in between the pictures and rule horizontal line after pasting each. The lecturer groups students to a convenient number, give each group cardboard with pictures pasted on it and asks each group to look at the picture critically and develop a scenario on what they feel or see about the picture as it relates to “family”. Scenario building teaching strategy is very appropriate when a lecturer wants students to apply their knowledge and critical thinking skills in decisions making, solving problems and exploring issues (Kelly,

2015). This teaching strategy enables the lecturer to pull out information from students instead of pushing information onto them. At the end of the activity, there would be a plenary session where group leaders are allowed to present their works one after the other and students are allowed to make observations and contributions.

The next teaching strategy to be addressed is case study. Case study teaching strategy is an effective student-centred learning strategy. Schwartz (2014) opined that case study teaching strategy is a powerful student-centred teaching strategy that can impact students with critical thinking, communication and interpersonal skills. Case study is effective at developing real-world professional skills and it increases students' proficiency in written and oral communication as well as collaboration and teamwork (Daly, 2002). Case study can be seen as a strategy which engages students in teaching and learning processes and develops in them essential teaching skills required of a professional teacher such as critical thinking, communication, collaboration and problem-solving skills. Schwartz (2014) pointed out that in case study, student involvement develops on three distinct levels: students explore a problem by sorting out relevant facts, developing logical conclusions and presenting them to fellow students and instructors. Students can be assigned roles in a case, and take on perspectives that require them to argue for specific actions from a character's point of view given their interests and knowledge. Students will take the initiative to become fully involved so that topics are no longer treated as abstract ideas. In carrying out a case study activity, the lecturer needs to develop a case that will address the objectives of the subject matter with a set of questions. Students are grouped to a convenient size. The lecturer asks each group to choose a group leader, each student is given a copy of the case study and given ample time to read the case study individually and answer the questions collectively while the lecturer monitors them to ensure everyone is participating in the activity. After that, there will be a plenary session where the leader of each group comes out to present the group work. The next teaching strategy is plenary session.

Plenary session is a teaching strategy which provides an opportunity for learners to make presentations, observations, and critique classroom activities. It is a time to clarify students' misconceptions concerning the concepts just treated. Plenary session teaching strategy is an exercise which takes place at the end of every class activity to ascertain what happened during the group activities (Community, 2018, March 15). Plenary session could involve asking students some questions, a short quiz or peer evaluation tasks which are purposely meant to evaluate if stated objectives have been achieved. Hartwell (2017) identified the following as features of an effective plenary session: plenary session allows the teacher to assess the whole class understanding at once; it is planned into a lesson where appropriate and used to summarise learning which is not necessarily at the end of the lesson. In other words, plenary can be used as an effective form of assessment within a lesson and arranged in line with the objectives of the lesson. Plenaries give students the opportunity to reflect on what and how they have learnt and guide them to the next step of success. Plenary session teaching strategy is a way of structuring students' reflection time, providing an opportunity for learners to clarify issues they did not quite understand and it allows weak students to celebrate what they have done well (Hartwell, 2017).

The procedure for plenary session teaching strategy involves the lecturer arranging students in convenient groups, each group choosing a group leader, and assigning groups tasks to brainstorm on and find a solution to. The timeline will be given to complete the task. When they are done with the work, the plenary session will be declared. During the plenary, group leaders come out to present their work within a given timeline. At the end of each presentation, class members are asked to make observations, seek clarification or contribute to what the group has presented. Any posed question is answered by any member of the group not only the group leader. This exercise gives students the opportunity to interact with

themselves. This teaching strategy would help social science education teacher trainees to develop critical thinking skills, collaborative skills, decision-making skills, self-confidence and the ability to address a crowd. One of the important rules in this exercise is that monopoly of group leadership is not allowed. That means when activity is changed a new leader emerges.

There is no gainsaying that no education can develop better than its teachers. For student teachers to acquire quality teaching skills capable of revolutionizing the Nigerian economy, there is a need for skilful and knowledgeable teachers who are committed and dedicated to making a difference in teaching and learning processes. To produce individuals who will cherish peaceful co-habitation, and uphold societal norms, values, attitudes, truthfulness, honesty and transparency among others, there is a need for teachers who can use effective teaching strategies to inculcate these virtues in the students. This study, therefore, investigated selected teaching strategies that can be tools for training skilled social science education teacher trainees at the University of Nigeria, Nsukka.

Purpose of the Study

The purpose of this study was to examine selected teaching strategies as tools for training skilled social science education teacher trainees at the University of Nigeria, Nsukka. Specifically, the objective of the study is to determine the efficacy of the selected teaching strategies on social science education teacher trainees.

Research Question

The research question that guided the study was: What is the efficacy of selected teaching strategies that could be utilized in the University of Nigeria to prepare skilled Social Science Education teacher trainees?

Theoretical Framework

This study is anchored on Jerome Bruner's (1961) theory of Discovery Learning. This theory states that a learner should draw from his/her experience and existing knowledge to discover facts and relationships and new truths to be learned. For instance, when students are grouped and presented with learning experiences through different teaching strategies, the student with his or her existing knowledge discovers the relationship between the learning experience and what he or she is expected to learn newly. With the teaching strategies, students are encouraged to apply critical thinking ability to draw knowledge from their previous experience to provide an answer to new ideas. This theory is relevant to this study because teaching strategies engage students in class activities, and allow them to explore their experience to discover knowledge in the task assigned to them. Proponents of discovery learning theory believe that discovery learning encourages active engagement, promotes motivation, autonomy, responsibility and independence, develops creativity and problem-solving skills and tailors learning experiences.

Research Methodology

One hundred and thirty-five social science education teacher trainees at the University of Nigeria, Nsukka, were involved in the study. The entire population of 135 were used and so there was no sampling. Participants were taught for one semester (3 months) using group discussion, island hopping, case study, scenario building and plenary session teaching strategies. Students were not informed that they were participants in the research study. This was purposely done to avoid the effect of test sensitization which would have created a consciousness in them that would affect both their degree of participation and responses. After teaching the course contents with the five teaching strategies for the semester,

participants were given empty feedback slips to write what they feel about the teaching strategies. To ensure participants write freely, they were told writing their names on the feedback slip was optional.

Contextual research design was adopted for the study. Contextual design is a step-by-step process for collecting field data and using it to design any sort of product that includes a technical component (Holtzblatt & Beyer, 2017). This implies that contextual design allows researchers to go to the field, observe and talk with participants in their natural learning environment, collect data about participants in the field, and interpret and use findings to create and prototype products or services. Hence this design is appropriate for the study. Content analysis was used to analyse the data collected. Content analysis is a research technique used to make replicable and valid inferences by interpreting and coding textual materials by evaluating texts such as documents, oral communication and graphic (The University of Georgia, 2012, October 10). Content analysis is also a research tool used to determine the presence of certain words or concepts within texts or sets of texts researchers quantify and analyse the presence, meaning and relationship of such words and concepts, then make inferences about the messages within the texts, the writer(s), audience, culture and time they are part of (Palmquist, 2004). Hence this study made use of content analysis to record observable and quantifiable data based on classification and analysis of the open-ended feedback slips distributed and collected from teacher trainees.

The responses of participants were thematically classified under five teaching strategies which the study focused on. Student teacher trainees responded on the efficacy of those teaching strategies in inculcating teaching skills in them. Frequency and percentages were used to analyse the data collected. Items that scored 50% and above were accepted while those that scored 49% and below were rejected.

Results

This session presents the results of the study.

Table 1: Teaching strategies that could be utilized in the University of Nigeria to prepare skilled Social Science Education teacher trainees

| S/No. | Efficacy of these Teaching Strategies | Frequency | Percentages (%) |
|-------|---------------------------------------|-----------|-----------------|
| 1 | Group discussion | 111 | 82.2% |
| 2 | Island hopping | 95 | 70.4% |
| 3 | Case study | 70 | 51.8% |
| 4 | Scenario building | 85 | 63.6% |
| 5 | Plenary session | 95 | 70.4% |

Table 1 showed the teaching strategies identified by the participants on a blank feedback slip. Group discussion was identified by 111 (82%) participants, island hopping was identified by 95 (70%) participants, case study was identified by 70 (52%) of the participants, scenario building was identified by 84 (64%) of the participants and plenary session was identified 95 (70%) of the participants. The result indicates that participants identified these teaching strategies as capable of inculcating teaching skills in social science education teacher trainees.

Discussion of Findings

The findings of the study revealed that participants agreed that group discussion is an effective teaching strategy skill to be inculcated in social science education teacher trainees. This is reflected in the participants' comments like *"group discussion gives everyone the opportunity to fully participate. I like it because it brings out all potentials in a person"*. *"As a future teacher, I will love to adopt group discussion, it is really interesting, loving, in short, the best teaching strategy because it has really motivated me to know more"*. *"Group discussion is good as ideas are shared from those who understand to those who don't which gave everybody equal participation. I think this method is the best"*. *"This method fosters teaching and learning among students and not the usual method where the teacher does the whole work"*. *"I love it because working in group or working as a team make us strong and again all fingers are not equal, so doing it individually will affect somebody like me in terms of out spoken"*. *"It enable students to be critical thinkers, it is also student centred, it enables the students to air their view about a certain topic, and broaden students horizon"*. *"It has enhanced teaching skills of students who want to be teachers in future"*. *"It has brought togetherness among students, the strategy has really brought out the teaching skill in me"*, among other comments. The participants' comments are in line with Albemarle (2018) who observed that if group discussion is used effectively, it facilitates students' social development and provides opportunities for students to develop an understanding of their strengths and weaknesses related to a specific task or assignment while developing strategies for strengthening their weaknesses through peer modelling and assistance.

The findings showed that island hopping is an effective teaching strategy skill which would help participants to be effective teachers. Some confessed that, *"I cherish island hopping because it made the students feel the reality and need to discuss"*. *"Island hopping help us to interact, know what another person thinks about a particular topic. It is a method that I will adopt in teaching"*. *"Island hopping is a very good teaching method because teaching involves both inside and outside classroom"*. *"Everybody must make a contribution in island hopping. It is good for teaching the introverts. It makes the introverts to start socializing with others because it gives room for everyone to contribute"*. *"I prefer this strategy more because it makes learning fun"*. *"Island hopping is very good teaching strategy as it takes one out of the classroom"*. *"I choose island hopping because it has low tendency for boredom and can be used to teach any set of people"*. *"Island hopping is inspiring and stimulates critical thinking"*. *"Island hopping helped me in being able to associate more with different people with different characters, more knowledgeable than I do and more influential"*. *"Island hopping is good because it is good to use when students are tired and not eager to learn"*. *"it gives us the opportunity to tour round all the topics"*. Their responses are in tandem with Nottingham Trent University (2018, March 30) observation that icebreaking activities like island hopping, are short exercises used to help students know little about one another and also intended to encourage students work with one another on a task.

The findings showed that case study teaching strategy develop in the participants' team spirit, communication skills and interpersonal skills. Some of the participants confessed among others and I quote that: *"case study teaching strategy used in teaching this course are excellent"*. *"it is super-interesting in the sense that it makes me relate situations to real life"*. *"It enables me to start painting mental picture of a situation I have little or no idea of"*. *"This teaching strategy made the class more interactive and creative"*. The participants' comments are in line with Schwartz (2014) who observed that case studies enable students to take the initiative to become fully involved so that topics are no longer treated as abstract ideas but become central to the students' sense of self, of what they would choose to do in a specific real-world situation.

The findings of the study also revealed that scenario building is a teaching strategy which develops in teacher trainees' critical thinking and problem solving skills which will make them become effective teachers who will produce critical thinkers of the time when they eventually join the teaching profession. Participants responded as follows, *"scenario building is good because many of us contribute to a particular topic"*. *"I cherish scenario building because it made the students think critically on the solution to the topic they were given and entails everyone's participation"*. *"This method is good as it is geared toward thought-provoking"*. *"We were thinking out solutions to problems and also with the help of internet"*. *"It helps one in critical thinking and analysis"*. *"I like this strategy because it helps us to be versatile in making research online"*. *"Scenario building made me to crack my brain and give a contribution"*. These responses are in tandem with Kelly (2015) who said that scenario-based learning is appropriate when the teacher wants students to apply their knowledge and critical thinking skills to make decisions, solve problems and explore issues.

The findings of the study also revealed that plenary session impacted the teaching skills of the participants. Most of the respondents confessed that this strategy makes the class democratic and offers students an opportunity to air their views concerning any topic or issue, allowing students to clarify confusing issues and develop leadership traits. Some of them said that, *"I cherish plenary session because it is where students are free to ask questions and argue"*. *"I so much love this strategy because it trains me for the better teacher am meant to be in the society"*. *"This is also another one I am likely to use because when this strategy is applied it brings out the potential in the learners"*. *"Plenary strategy is good because it makes us to be bold when speaking in public, say no to shyness"*. *"This helps the students in the aspect of building communication skills and also helps them to conquer shyness"*. *"This helps so much as it build confidence among students in the cause of presentation. This help student teachers to overcome problem of stage fright and believe in themselves"*. *"Plenary session is good because it helps students especially we that are in teaching field to practice how to carry on our profession after school, how to be outspoken, how to reduce stage fright and develop a sense of self-esteem"*. Participants' comments are in tandem with Hartwell (2017) who opined that plenary session teaching strategy is a way of structuring students' reflection time, providing an opportunity for learners to clarify issues they did not quite understand and allowing weak students to celebrate what they have done well. It can be said that plenary session teaching strategy help student teachers build communication skill, self-confidence and boldness to overcome stage fright and develop critical thinking.

Table 1 also revealed that participants appreciated the five teaching strategies under the study and confirmed that they are interesting, interactive, participatory and experiential. They said among others that *"the strategies of teaching are super-interesting in the sense that everyone airs their views concerning a topic and possible corrections are made for those who are still in confusion for clearance"*. *"These teaching strategies gave us flat forum to think critically"*. *"I must confess that the strategies of teaching is the best I have ever seen especially the one called "island hopping"*. These responses agree with Lockhart (2018) submission that a variety of teaching strategies helps students take responsibility for their learning and enhance the process of teaching and learning.

Some participants made commitment statements such as *"I will make use of this my lecturer's method of teaching because I think is one of the best way you can teach and students will understand"*. *"I promise myself that I will use these methods when I will go for teaching practice and when I will become a lecturer"*. *"Your class is awesome, I love the teaching strategies you used to teach and when I become a lecturer, I will use these strategies in teaching"*. *"I as a teacher will like to implement these strategies to enable all my class members to participate in the classroom"*.

Some of the participants suggested that *“with the way I was taught in this course, I would like to recommend that other lecturers use these strategies because it is interactive and it helps students recollect all that he or she has been taught”*. *“The teaching strategies we use in this lecture is the best method ever, I recommend these strategies of teaching to other lecturers”*. *“I love the class, it is an interactive class, and this is the part of teaching strategies that we suppose to implement in our educational system because it will help and give room for every student to participate in the classroom”*. *“The teaching pattern is quite democratic where everyone is given an opportunity to voice out their opinions on a particular subject matter*. To support these responses, Hosan (2016) reported that solely providing curriculum materials to teachers is not sufficient to facilitate robust student learning rather designing and identifying high-quality instructional tasks and implementing them with students are core aspects of teaching that can influence students' opportunities to learn in the classroom.

Conclusion

It is apparent that teaching strategies such as group discussion, island hopping, case study, scenario building and plenary session are effective tools for training skilled social science education teachers. Sequel to the findings of the study, it is concluded that these teaching strategies are interactive, participatory, engaging, motivating and inspiring. They make learning faster and encourage socialization among students. They also develop the students' problem-solving, critical thinking and communication skills which are imperative for a skilled teacher.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. The university authorities should encourage lecturers to use these teaching strategies during teaching and learning.
2. University education curriculum planners should not only include methodologies but also teaching strategies in the curriculum for the effective implementation of learning objectives.
3. The Federal government and university authorities to build the capacity of lecturers in the use of these teaching strategies.
4. University authorities should advocate for the use of teaching strategies through seminars, conferences, and radio and television jingles.

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PRE-SERVICE TEACHERS' EXPERIENCES ON THEIR ASSESSMENT THROUGH ONLINE METHODS DURING COVID-19 ERA: A CASE OF SCHOOL-BASED WORK INTEGRATED LEARNING

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Abstract

The outbreak of COVID -19 has forced tertiary institutions to fast adopt online teaching as an alternative to the traditional face-to-face teaching. This included approaches to teaching practice, which had to be in line with COVID-19 protocols. The purpose of the study was to investigate the student-teachers' experiences on their assessment through online methods during School-Based Work Integrated Learning (SBWIL) in the era of COVID-19. This qualitative research study used phenomenological approach to collect data through open-ended interviews and focus groups discussions. Twenty (20) Bachelor of Education final year students were purposively selected to participate in the study. It emerged from the data that student-teachers enjoyed SBWIL during COVID-19 as there were no face-to-face contacts with their university-based lecturers, which made them own their professional space with less anxiety. The study also found that student-teachers were using their readily available gadgets to record their lessons and were comfortable with feedback from peers. The study recommends that tertiary institutions should embrace online assessment method for SBWIL as a viable option beyond COVID-19. Furthermore, the study also recommends that government should provide budgetary support for universities to upskill their staff and to develop their infrastructure to support online teaching.

Keywords: COVID-19, School-Based Work Integrated Learning, online-assessment, technology, learning tools.

Introduction

The speed at which COVID-19 pandemic spread from when it was detected in Wuhan to its spread throughout the globe, forced a change in the way teachers, students and workers approached their lives, interacted, worked and engaged with teaching and learning (Flores & Swennen, 2020). The COVID-19 pandemic, therefore, became a great disruptor even in the higher education (HE) sphere as universities were forced to innovate in their education offerings. This disruption also necessitated drastic changes in the pre-service teacher education programme. The changed terms of engagement with regards to pre-service teacher education, necessitated a move to new ways of teaching, learning and most importantly assessments, particularly within Teaching Work Integrated Learning (WIL) module (Duku, et al, 2022a). The prevailing conditions forced universities to rethink teaching and assessing WIL. Based on the above discussion, the pandemic placed institutions of higher learning on a precipice where they could either be on a verge of collapse as a result of overwhelming changes imposed by COVID-19 pandemic or adopt and adapt new learning innovations.

The national lockdown regulations which restricted face-to-face teaching, impacted negatively on WIL for pre-service teachers, a critical and indispensable component of pre-service teacher education. Whilst the HE sector was undergoing radical changes, the Basic Education sector which hosts pre-service teachers during WIL was equally experiencing some changes. These included enforcing social distance in the classrooms and rotational

classes (Duku, et al, 2022b). In South Africa, pre-service teacher education is regulated by, Policy on Minimum Requirements for Teacher Education Qualifications (PMRTEQ; DHET, 2015), which requires that:

- The learning-in-practice, workplace-based component of WIL for teacher education qualifications mostly take place in classroom and school settings but could also include a small component of service learning in community settings.
- It is the responsibility of the institution offering the qualification to formally arrange WIL opportunities for pre-service teachers, in line with the requirements of the qualification as described in the policy. This implies developing mutually beneficial partnerships with schools.
- The workplace-based component of WIL must be structured, supervised, integrated into the learning programmes, spread across the learning programme and it must be formally assessed.

WIL is a crucial component in the academic life of a pre-service teacher as it provides an opportunity to further develop teaching expertise in selected host schools (De Souza, 2017). The host teachers provide mentoring during praxis which is irreplaceable and a prerequisite for a teacher qualification. While undergoing this exercise, pre-service teachers are expected to improve and spread their ability in lesson planning, skills for making and utilization of teaching and learning resources, and strategies for effective classroom and discipline management (Okeke; van Wyk; Adu; Wolhuter & Abongdia, 2016). The outbreak of the COVID-19 pandemic forced the selected higher education learning institution (HEI) to abandon planned face-to-face WIL-related assessment activities for the 2020 academic year. This paper therefore sought to assess the extent to which the COVID-19 pandemic disruptions influenced WIL- related assessment for pre-service teachers. This was done by investigating the pre-service teachers' experiences of their assessment through online methods during COVID-19 era. The guiding questions are: How did pre-service teachers experience WIL online assessments during COVID-19? And what was the pre-service teachers' views regarding COVID-19 impact on WIL?

Literature Review

The value of WIL in training

The purpose of WIL is to provide pre-service teachers with knowledge, skills, attitudes, and understanding of their chosen profession. Furthermore, it is to provide an opportunity for pre-service teachers to further develop their teaching competence while host teachers at the selected schools (De Souza, 2017) provide mentoring during praxis. WIL presents pre-service teachers with an opportunity to gain onsite exposure and experience in a school setting; to observe, learn, interact and reflect on their school practice under mentorship of experienced and professional educators (Council on Higher Education, 2011 & Jackson, 2017).

During WIL pre-service teachers are expected to advance and extend their capability in lesson planning, skills for making and utilization of teaching and learning resources, and strategies for effective classroom and discipline management (Okeke et al 2016). Also, WIL programmes benefit the students in the following (Jackson, 2017):

- Academic advances, such as an enhanced knowledge base, the promotion of interdisciplinary and critical thinking, and a support for lifelong learning.
- Personal qualities, such as improved interpersonal competences, teamwork and leadership development.
- Career gains, such as career path clarity and being able to take ownership of career planning, awareness raising of personality strengths and weaknesses, developing a professional identity and the development of professional work values and ethics.

- An increase in overall competence, which includes the development of specialised and personalised knowledge and skills.

Given the value of WIL on teacher education, it implies that there cannot be any effective teacher preparation without pre-service teachers visiting schools to practice teaching in the real school situation. Therefore, the quality of practice opportunities is as important as where and how it is done. WIL, which is practice-based offers opportunities for pre-service teachers to integrate both content and pedagogy acquired through coursework in real school contexts (Ericsson, 2012). Thus, pre-service teachers should embed practice-based opportunities with what has been taught and align that with field experiences that are aligned with skills and practices taught. Therefore, work based integrated learning afforded the pre-service teachers with;

- An opportunity to engage with students, thus increasing their ability to put theory to practice by solving problems on site (de Beer, Petersen & van Vuuren, 2020). This is where the rubber hits the road.
- Opportunities to practice and acquire expertise in the subject matter as well, such as a specific skill set that is learnt and developed in the workplace and is directly related to the academic teaching at an HEI (van Niekerk, 2018).

Conversely, WIL is a deliberate, goal-oriented rehearsal that is paired with reflection on the pre-service teachers' part. Furthermore, the faculties of education around the world should prepare for face-to-face interaction between pre-service teachers and learners at schools. With the loss of face-to-face teaching, educational institutions faced a state of disruptions (Woodside, 2020) because of COVID-19, since the pre-service teachers could not practice what they were taught and learned at the teacher education institutions (Heick, 2020).

Future teachers not only in South Africa, had to navigate the process of being dependent on technology as a result of COVID-19 pandemic.

The impact of COVID-19 on Higher Education Institutions.

Shifts to virtual schooling posed a threat to the traditional way that pre-service teachers were used to in terms of assessment. The selected educational institutions were not armed to provide WIL using online-based platforms. The face-to-face mode of teaching and assessment had to fall away because of the regulation restrictions (Sahu, 2020). These COVID-19 regulation restrictions were experienced in the midst of enormous challenges facing the South African education system. These challenges include inequality, unacceptable learner dropout rates, substance abuse, gender based-violence, problematic teaching quality and others (SACE, 2018). This imposed an imperative that HEIs that train teachers were duty-bound to make sure that teachers trained at these institutions were sufficiently equipped to deal with the challenges confronting the teaching profession (CHE, 2011).

With the advent of the COVID-19 pandemic, the serious challenge facing institutions that train teachers was how to conduct online assessment of pre-service teachers on WIL without compromising the standards and value of WIL. The fact that the COVID-19 pandemic was an unapparelled pandemic in recent history exposed lack of preparedness and vulnerability amongst the selected HEIs. COVID-19 further exposed the inequalities within and between universities in that some universities were well positioned to move to online teaching and continued with the academic year, whilst others experienced severe constraints with regards to students' poor access to technology and poor socio-economic circumstances (du Plessis et al, 2020). Universities like University of Johannesburg were at an advantage to quickly adapt to the new normal as they already experimented with online and blended

learning. Formerly black and disadvantaged universities struggled to adapt to online learning due to lack of resources (Gilili, 2021). The lockdown of universities and schools forced numerous pre-service teachers and learners to stay at home, where there was limited connectivity. The schools in rural areas did not have the necessary infrastructure to carry out online teaching or assessment to accommodate the pre-service teachers to practice what they have learned about classroom management and other skills. Although the HEIs opted for online platforms, this could not adequately fulfil the WIL intentions with regards to pre-service teacher preparation, as blended learning limits opportunities offered by traditional teacher training method, viz - face-to-face interaction. These include the fact that traditional teacher training methods offer skills like classroom management and necessitated that both the teacher and the learner are physically present and with some element of student control over time, pace, and path (Jansen, 2020).

Government strategies to mitigate COVID-19 impact

As COVID-19 necessitated that blended learning should be the norm, most students in the rural areas did not have the necessary gadgets to access the platforms (Sayed & Singh, 2020). This forced some of the educational institutions of higher learning to collaborate with NSFAS to acquire digital devices and network data providers to service students in need, including students who were to do WIL. This enabled the needy students to be on par in terms using technology to engage with WIL (Duku, et al, 2022). The selected schools were not exclusively affected by the suspension of face-to-face teaching in 2020, as it is reported that more than 1,2 billion learners and students were also disadvantaged globally (UNESCO, 2020, Jansen, 2020). This also meant that pre-service teachers had to be assessed through digital platforms; including the assessment of WIL. Cheng et al. (2013) posit that most online assessments use tools like students' written performance as evidence, as would be shown through online exams, in virtual discussion boards, in portfolios, and by written essays. This assertion of these scholars refers to the assessment of course work and not necessarily WIL, which is a practice-based activity.

Theoretical Framework – Online Collaborative Learning Theory

Theoretical lenses of online collaborative learning (OCL) were applied to investigate Student Teachers' experiences on their assessment through online methods during COVID-19 era. OCL theory is based on the philosophy that focuses on using internet resources to create learning environments that promote cooperation and knowledge creation (Harasim, 2012). In order to reconfigure formal, non-formal, and informal education for the information era, a new paradigm of learning that emphasizes collaborative learning, knowledge creation, and internet use has emerged (Ibid). Three stages of group discourse-based knowledge production are described in OCL. These are 'idea generating', which refers to the brainstorming stage where various ideas are collected. The second phase of OCL is 'idea organising' and involves the process of arranging ideas, brainstorming, analyzing, and categorizing them. Mental confluence is the final stage. It is the stage where intellectual synthesis and consensus take place, including the ability to agree to disagree, frequently through the creation of a task, essay, or other type of collaborative effort (Harasim, 2012). OCL also has roots in social constructivism since it encourages students to work together to solve problems through discourse and because the teacher serves as both a facilitator and a member of the learning community. This is a key component of OCL as well as other constructivist theories, in which the teacher plays a more active role in knowledge construction rather than acting as a passive facilitator. It is challenging to scale up OCL because of how crucial the teacher's involvement is. OCL functions well in more intimate

learning situations, in contrast to connectivism, which is appropriate for large-scale instruction.

Research Methodology

The phenomenological technique, which was used for this investigation, focusses on lived experiences of the researched (Creswell, 2016). The main issue is with people and their diverse opinions, not theories, but informants, are consulted and believed. Empirical phenomenology study aims to represent the world as it is perceived by the participants in order to identify shared interpretations and empirically supported variations of a given occurrence. This qualitative research study used phenomenological approach to collect data through open-ended interviews and focus groups discussions. Twenty (20) Bachelor of Education final year students were purposively selected to participate in the study. Thematic data analysis method was used to analyse that data.

Results

This section presents the findings of the study in line with the two themes, namely the experiences of pre-service teachers about WIL online assessments during COVID-19, and the views of pre-service teachers regarding COVID-19 and its impact on WIL.

The experiences of pre-service teachers about WIL online assessments during COVID-19

Some of the participants expressed their frustration at not being able to continue with their WIL experience because of lockdown and social distancing that needed to be maintained as part of the regulation by government. They complained that they do not even have laptops to proceed with the online learning required, not that it would have made any difference to them as they are in rural areas.

Student 1: How does the government expect school experience to proceed when most of our schools do not have computers let alone internet connectivity. There will be no value in and purpose for school experience under lockdown regulations. Clearly student teachers will not benefit, as they do not have smart phones to take videos on their teaching practice nor the data to send the videos to their lecturers for assessment purposes.

As a result of the absence of the critical digital tools and the closure of schools during lockdown,

Student 2: How can we as pre-service teachers gain the experience we need in order to pass the module if the schools are closed because of COVID-19 and the absence of ICT tools?

Pre-service teachers interviewed seemed hopeless of the situation to the extent of giving up for the current year. Whilst it is an accepted fact that COVID-19 has catapulted the education sector to the level of 4IR, there is an unintended consequence to it. Most rural schools do not have internet connectivity, and the situation is worse for individual learners and pre-service teachers.

Student 3: Most students had never seen or touched a computer in their lives, so virtual learning is not accessible nor helpful to them. It students from well off families and from urban and upmarket schools that stand a chance to benefit from online teaching. With the lockdown regulations, most rural and poor students are still stuck where they were before lockdown.

It can be noted from the above excerpt that COVID-19 pandemic exposed inequalities between rich and poor in terms of access to digital tools. This was echoed by Student 4 who acknowledged and stated, *“When I arrived in the university, I did not have a laptop as in my previous high school, no learner had ever owned one”*. This inequality seems to be experienced in both Department of Higher Education and Training (DHET) and Department of Basic Education (DBE) systems, and further perpetuated the situations. Unfortunately, the situation was exacerbated by unfulfilled promises of resource provision by government.

The views of pre-service teachers regarding COVID-19 and its impact on WIL.

When asked about their views regarding COVID-19 and its impact on WIL, pre-service teachers reported that they were facing serious challenges with regards to visiting schools and that it was impossible to do WIL by means of face-to-face interaction. For instance, Student 5 nervously lamented;

This means that we pre-service teachers must do the same module again because we did not go to teaching practice.

It can be noted from the above that pre-service teacher's view that the inability to visit school during COVID-19 pandemic especially during lockdown impacted negatively on pre-service teachers' academic progress and caused some anxiety. Emphasising more on the importance of a face-to-face interaction between the pre-service teachers and the learners in the classroom, students 6 and 7 respectively shared;

We will have to repeat the module (WIL) because we were not exposed to practical aspect of teaching.

The challenge that we had as pre-service teachers was the unavailability of interaction with the children

Regarding the availability of digital tools during the lockdown, it emerged from the data that there were some delays in the provisions of gadgets this particular university as student 10 complained;

It took 4 months for the university to allocate us with laptops and data. The situation did not improve even when we went to schools for WIL after lockdown.

Discussion

It emerged from the data that the WIL online assessment of pre-service teachers during COVID-19 era, exposed inequalities and digital divide between the rich and the poor as was evidenced by pre-service teachers who indicated that their access to digital tools was lacking. This implies that as much as online teaching and learning is important for all intentions and purposes such as connecting people across the globe and more especially stopping the spread of the virus, it fell short of addressing the needs of learners/students who could not afford it and the importance and value of face-to-face interaction that comes with its benefits. These inequalities were, according to Seepe (2020), social injustices and systemic imbalances resulting from unfulfilled promises on the part of the government to provide digital tools and access to online learning. The inequalities which were experienced during COVID-19 era by pre-service teachers on their WIL online assessment was an indication that, those from privileged institutions of higher learning had an advantage over those who are less privileged. This is in line with Sayed and Singh (2020), who noted this situation as an exacerbation of the existing struggle and suffering of the poor.

Traditionally, before the pandemic struck, universities would send out lecturers to visit pre-service teachers and host teachers to observe the teaching and classroom management of pre-service teachers amongst many things and to talk to host teachers about strengthening the

capacity of pre-service teachers. However, the COVID-19 restrictions have meant that all these logistics have to be cancelled and new possibilities explored. Even though universities have to invest in unbudgeted costs like laptops, modems, and data, these are long-term investments. The reality of the matter is that work based-integrated learning of pre-service teachers was negatively affected in the time of COVID-19 because of school closures and lack of digital tools.

Conclusion

It can be concluded from this study that some pre-service teachers had negative experiences about their WIL online assessment as they seemed to struggle during COVID-19 pandemic. This struggle was due to the reported inadequate digital tools and poor network connectivity in some areas. Furthermore, the study deduced that uneven distribution of digital infrastructure and tools to universities and schools was as a result of lack of political will by government to expedite redressing the imbalances that were caused by social injustices of the past governments. The study also concludes that access to digital tools and network connectivity as a vehicle for education in this digitalization age has become a justice issue.

Recommendations

HEIs in their policies need to legislate ICT capacity building and ICT tool access and acquisition for all students. Furthermore, ICT needs to be an integral part of the pre-service teacher education in South Africa.

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USING COOPERATIVE LEARNING FOR PROMOTING CLASSROOM INTERACTION IN THE TEACHING OF ENGLISH 2ND LANGUAGE IN THE RURAL SCHOOLS

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Abstract

The teaching and learning process has to be learner-centred and promote classroom interaction – especially in language teaching. However, this is not the case in many schools in South Africa, since teachers do all the talking while learners passively listen (a teacher-centred teaching approach). The purpose of this article is to report on how the use of cooperative learning improved classroom interaction among teachers and learners in the teaching of English First Additional Language (EFAL). The study was conducted in the rural areas of the Limpopo province, to determine why classroom interaction was not implemented in the classrooms. Nine teachers from four primary schools participated in the study. Of the nine teachers, eight were female, their ages ranged between 28 and 45 years, while their teaching experience ranged between 7 and 15 years. Each teacher taught between 50 and 60 learners per class. Overcrowding and teacher attitude were found to be the main reasons for the lack of classroom interaction in the classrooms. A workshop was conducted to train English teachers on cooperative learning (or small group teaching). A few months after the workshop, schools were visited to monitor the implementation of the principles of the training, as well as to support teachers who encountered challenges in applying the recommendations of the training. The majority of teachers were found to have seated learners in groups, and introduced group discussions. It was concluded that cooperative learning could go a long way in promoting classroom interaction and a learner-centred teaching approach.

Keywords: Cooperative learning, English 2nd Language, Rural areas, Overcrowding, Disadvantaged backgrounds.

Introduction and background

The classroom is a small society, in which learners learn to freely and naturally communicate with one another. The classroom is viewed as a primary institution for socialisation, a common setting for conventionalised behaviour, and a perfect place for young children to adopt language rules and learning strategies (Ding & Stapleton, 2016). Dukuzumuremyi and Siklander (2018) state that in a classroom the learners learn to collaborate with others, to relate to others and to manage or resolve conflict. The aforementioned activities can only take place through interaction between the teacher and the learner(s), and among learners themselves (teacher-learner interaction and learner-learner interaction). The quality of teacher-learner interactions in the classroom was found to have an impact on the learners' performance with good quality interactions leading to improved learner performance (Rido et al., 2014; Silinskas et al., 2017). The classroom interaction is crucial in lesson presentation, since it does not only encourage the active participation of learners in the lesson, but it also helps the teacher to determine the learners' level of understanding (Ding & Stapleton, 2016). In language teaching classroom interaction enables the learners to speak the target language in the presence of the teacher or others, who may be in a position to help if the language is incorrectly used. Zhou (2016) believes that classroom interaction in language teaching promotes language development by providing the learner with opportunities to practise the target language. Classroom interaction enhances the

development of language skills such as speaking and listening, and it also promotes critical thinking among learners (Azizan et al., 2018). In contrast, a lack of classroom interaction in a lesson presentation implies a teacher-centred teaching approach in which the teacher does all the talking and acting while the learners are passive.

The classroom interaction can only be realised if effective interactive teaching strategies are used. The interactive teaching strategies include cooperative learning, brainstorming, puppetry, role-play, story-telling and small group teaching (Yakovleva & Yakovlev, 2014). The interactive teaching strategies promote learning through joint activities of learners and can intensify the process of understanding, learning and creative application of knowledge to solve practical problems (Ishkov & Leontiev, 2015). Cooperative learning, as an interactive teaching method, promotes collaboration, teamwork, interdependence and individual accountability (Forslund & Hammar, 2018). Cooperative learning means learners work together in small groups to solve a problem by means of sharing knowledge and responsibilities, such that the solution to the given problem becomes the contribution of each learners' submission (Munir et al., 2018). During cooperative learning, learners learn from others in an organised and structured way, while instruction focuses on stimulating, coordinating and encouraging interactions among learners (Shimazoe & Aldrich, 2010). Cooperative learning is more desirable in the teaching and learning of a language – since it does not only create more opportunities for learners to speak the target language, but it also promotes communicative teaching and removes speaking anxiety which is experienced by learners when using a foreign language (Azizinezhad et al., 2013; Zhou, 2016). Cooperative learning was also found to help learners with retention and critical thinking (Çelik et al., 2013). Navarro-Pablo and Gallardo-Saborido (2015) noted that cooperative learning is appropriate for large classes, since each learner focuses on the activities of their small groups – thus making learning more personal and dynamic. Therefore, cooperative learning could be an attempt to compensate for individual attention, which is missing in the teaching of large or overcrowded classes. The other value of cooperative learning is continuous assessment or assessment that occurs throughout the lesson. Yakovleva and Yakovlev (2014) noted that cooperative learning enables the teacher to quickly realise where learners misunderstood something and thus help them accordingly – and not to wait for some summative assessment (weekly, monthly or quarterly) in order to determine any misunderstanding or slip-offs by learners. Although a number of studies have confirmed that cooperative learning has positive cognitive and affective effects on learners (Jalilifar, 2010; Ning & Hornby, 2014), its successful implementation depends on the teacher's abilities and the learners' faithfulness (Tamimy et al., 2022). Hence, proper preparation is required if cooperative learning is to be effectively implemented.

The purpose of this study was to determine the extent to which classroom interaction was implemented in the teaching of English First Additional Language (EFAL) in the rural areas of Limpopo, especially after the teachers were trained in classroom interaction.

Theoretical Framework

The Cooperative Learning Theory (CLT) of Vygotsky informs this study. CLT proceeds from the premise that social interaction is crucial for the development of cognition (Vygotsky, 1978). According to Vygotsky (1978), CLT involves the process of socialisation, which requires the individual to play an active role in it – in order for learning to occur faster and more efficiently. Vygotsky (1978) emphasises the concept zone of proximal development (ZPD), which is the gap between what learners already know and what they ought to know. According to Vygotsky (1978), that gap can only be closed through interaction with others who know better than what the learners know. This implies that no learning may occur successfully if the individual is not actively involved in that learning process. Vygotsky

(1978) emphasises the issue of the inner speech, by which he means that when people talk, the internalisation of words uttered occurs, and this internalisation of words promotes communication, the development of cognition and the development of inner speech.

The CLT is relevant for this study, since it emphasises communication, cognition and internalisation of words – which are important in the teaching of EFAL. Classroom interaction is communication around a specific topic, and it requires a thorough application of the mind around the topic, or a good knowledge of the topic under discussion. In addition, since EFAL is also the language of learning and teaching (LoLT), the mastery of communication, cognition and internalisation of words in EFAL enables effective learning in other areas/subjects.

Research procedure and method

The study was conducted in the rural areas of Limpopo. Limpopo is one of the poorest provinces of South Africa, and it is characterised by high rates of unemployment, a lack of infrastructure and inadequate provision of resources for education, health and social welfare (Omarjee, 2017).

This study was influenced by the researcher's school visits and classroom observations (also known as class visits). The classroom observations indicated a serious lack of classroom interaction in the teaching of EFAL in the area. Once the lack of classroom interaction was identified, a training session was arranged for the purpose of helping teachers to address the lack of classroom interaction. The training session was on seating learners in small groups and allowing interaction among learners within a group. After the training, a study was undertaken with the purpose of determining how successful the training was in promoting classroom interaction. This paper reports on the impact of the training.

The study was qualitative in nature. Semi-structured interviews and classroom observations were used to collect data. Semi-structured interviews allow participants to provide rich information, which the researcher could explore further through probing (McMillan & Schumacher, 2010). In observation, the researcher uses all their senses to examine people in their natural settings or to observe naturally occurring situations (McMillan & Schumacher, 2010). Individual teachers were observed in their classrooms during the actual lesson presentations. The purpose of the class visits was to observe how classroom interaction was practically implemented during the lesson presentation. The following aspects were observed during these class visits: seating arrangement, teaching approach and learner responses.

Population, sample and sampling strategy

The population for this study was teachers who were teaching EFAL in the Intermediate Phase (Grades 4-6) in the Mogodumo Circuit of the Limpopo Province. Nine teachers from four primary schools participated in the study. Of the nine teachers, eight were female, whose ages ranged between 28 and 45 years, while their teaching experience ranged between 7 and 15 years. The male participant was 43 years old, with a teaching experience of 11 years. All the participants used Sepedi as their home language, and were appropriately qualified to teach in the primary schools. Most of them held a three-year Primary Teachers' Diploma, which is a minimum qualification required for teaching at a primary school in South Africa. Each teacher taught about 60 learners. This implies that code-switching was not a problem since the learners often needed explanation in their mother-tongue. The sampling strategy was purposive, since only teachers who taught EFAL in the Intermediate Phase participated in this study.

Procedures for data collection and data analysis

The study was influenced by random school visits, which found that classroom interaction was not implemented in the teaching and learning of EFAL. This implied that learners did not have the opportunity to interact in English during the lesson. Hence, training in classroom interaction was arranged for these teachers. For this study, data collection occurred about three months after the training. The purpose of allowing three months to pass before teachers were interviewed was to allow them to apply the training approaches and observe reactions of learners before they could express an opinion. For purposes of data collection, appointments for class visits were made with individual teachers. The teachers checked their timetables and made the researcher aware of the times of their lesson presentations. Therefore, teachers were allowed to choose their classes, and the researcher only visited classes in which he was invited by the teacher. The purpose of allowing teachers to choose groups to be visited was to ensure that teachers picked groups in which they felt more confident or in which they felt that the learners were more cooperative. The classroom observations or class visits occurred first, and immediately thereafter the semi-structured interviews followed. The interviews took place on the school premises. A tape recorder was used with the permission of the participants. Notes were also taken during the interviews. Each interview session took about 30 minutes.

For purposes of data analysis, coding was used. The coding of data is the process of transforming collected information into a set of meaningful and connected categories (Winke, 2017). Coding also helps to reduce the volume of data into small chunks of meaning (Maguire & Delahunt, 2017). In this study, words with similar meanings were placed together to form categories, from which themes emerged (Maguire & Delahunt, 2017). The themes were scrutinised in terms of the research question and the purpose of the study.

Findings from the interviews.

The themes retrieved from the data collected are indicated below.

Change of Attitudes towards EFAL teaching

Eight of the nine participants indicated that they did not specialise in EFAL teaching, but were compelled to teach it. However, the attitudes of these teachers changed after the training session, and viewed the teaching of EFAL in a positive light.

Teacher B said: *'Many of us were just allocated EFAL to teach, whether we liked or not. But after the training, I enjoy teaching EFAL, because of learner participation'*.

Teacher H said: *'I was forced to teach EFAL because there was no one willing to teach it. But now I enjoy it so much. To see learners speaking to others in their groups is exciting'*.

Teacher A said, *'Since I sat learners in small groups and allowed them to discuss, I am more able to support them in their small groups'*.

Teacher D said, *'I am able to hear what a few learners say in their groups, and help them accordingly. This arrangement is much better than seating learners in rows. That old seating arrangement forces you to teach them all at once'*.

The implication here is that the changes in the seating arrangement from rows to small groups had a positive impact on the attitude of teachers. While teachers were initially unhappy with being allocated EFAL to teach, the training brought about a new and exciting way of teaching EFAL. The teachers' positive attitude may have led to happier and productive learners, who benefitted maximally from the teaching and learning process.

Classroom interaction

The teaching of a language should be accompanied by communication in the target language, especially during the teaching and learning process. During the random school

visits (observation before training), the interaction between teachers and learners, and among learners themselves was non-existent. The teaching strategies that promoted classroom interaction were not implemented, since the EFAL teachers simply lectured or talked most of the time. However, during this observation (after the training), the teacher-learner and learner-learner interactions improved dramatically. The teachers had the following to say:

Teacher I said, *'In the past, the learners did not respond when I spoke in English to them, so I was forced to speak in Sepedi so that I get some responses from them. But since I sat them in small groups, they respond well since the answers are discussed and everybody is willing to answer. The self-doubt is gone'*.

Teacher F said, *'I did not expect these learners to have a conversation in English, or to give long answers in English – hence I asked questions in such a way that answers were short, one word or one short sentence'. But now one learner can give an answer and explain it when I ask a further question'*.

Teacher G: *'Since the class is too big, I made the learners to speak in a chorus. However, with the small group seating arrangement, learners speak in their small groups, and they speak to the teacher or to other learners in the group'*.

Teacher B said, *'When learners are seated in rows, only one or two learners may occasionally speak, whereas in a small group setting, learners exchange ideas in their groups – meaning that more learners take part in the discussions'*.

The implication is that classroom interaction was practised – since learners were provided with the opportunity to talk to the teacher and to discuss among themselves. Such an opportunity never existed before the training.

Findings from Observation

Observation was also undertaken twice, prior to the training and after the training. On both occasions, the participants were observed while presenting EFAL lessons in the classrooms. The following aspects were considered in both observations: seating arrangement, teaching approach and learner responses. Each aspect is briefly discussed below.

Seating arrangement: The observation conducted prior to the training revealed that the traditional seating arrangement of rows was employed by all the participants. However, during the second observation (after the training), learners were seated in small groups of about six learners per group – despite the fact that the classes were big, with about 60 learners each. The groups were arranged in such a way that there were spaces in-between the groups, so as to enable the teacher to access each group.

Teaching approach: During the first observation, the teaching approach commonly used by all the participants was the lecture method, whereby the teacher stood in front of the class, next to the chalkboard and lectured the learners. One learner was occasionally offered an opportunity to speak. The teacher occasionally asked questions, whose answers were short, and learners were expected to answer them individually or in a chorus (speaking all at the same time). The learners never had an opportunity to ask questions and to express their opinions on the topic under discussion. In cases of reading lessons, learners were instructed to read in a chorus. However, during the second observation (after the training) cooperative teaching was implemented. The teacher introduced the topic, asked a question and allowed groups to discuss it before providing an answer. The teacher moved among the groups, listening to group discussions and adding or correcting where necessary. In cases of reading, learners read to the group, with the teacher moving in between groups and listening.

Learner responses: During the first observation, the learners were mainly passive, only listening to the teacher, and occasionally answering a question individually or in a chorus, as indicated above. Absolute quietness among learners was expected, and they were

not encouraged to share information or discuss anything among themselves. The teacher also did not engage them in a conversation. However, the observation done after the training revealed interaction among learners and between the teacher and the learner groups. The classroom was buzzing as learners expressed their opinions about the topic or the question asked. The teacher ensured that noise levels were kept low by reminding groups to keep their voices low. The quiet and passive learners became active participants in the discussions, talking to each other and to the teacher.

Discussion

The biographical information of the participants revealed that all the participants were mature adults with many years of teaching experience. Although all the participants were qualified to teach at a primary school, only one of the nine participants (the male teacher) was trained to teach English at the primary school. Moreover, English is the third or fourth language for the majority of African teachers in South Africa (Nel & Muller, 2010). This implies that speaking and teaching English could have been difficult for the majority of the participants. In addition, the number of learners taught per class for each participant was very high, implying challenges of overcrowding, lack of individual attention and poor interaction among learners. The biographical data indicated a complex situation in which classroom interaction was difficult. However, the training in cooperative learning that the teachers had undergone proved to be very helpful, despite the difficult conditions under which these teachers operated.

The responses indicate that classroom interaction was implemented after the training. Initially, the teachers felt that it was difficult to encourage communication or interaction among learners since the classes were too big, with each class having about 60 learners. Consequently, the teachers were compelled to practise mass teaching or teaching all the learners at the same time. Mass teaching implied a one-way communication approach, in which the teacher did all the talking and learners passively listened (teacher-centred). The one-way communication implied that it was difficult to determine the extent to which learners understood the lesson, as they never had the opportunity to express an opinion or to answer a question. The classroom interaction helped the learners to practise the language in the presence of the teacher and classmates – people who could help when the learner was uncertain or wrong. Speaking English in the classroom may have helped learners to improve their vocabulary and to gain confidence in using the language.

The study revealed that the training in classroom interaction or cooperative learning changed the teaching and learning process from being teacher-centred to being learner-centred. The learner involvement in the lesson positively influenced the attitude of teachers. Most of the participants were not trained in EFAL teaching and thus developed a negative attitude towards teaching it. However, the training in cooperative learning changed their attitude and helped them to successfully implement classroom interaction in their EFAL classes. The large classes made the use of cooperative learning more valuable, since it allowed individual participation through small groups. Therefore, the implementation of cooperative learning addressed crucial issues in the situation of the participants, namely, the management of large classes, the individual participation of learners and the promotion of positive attitude among teachers.

The responses of teachers confirmed the value of cooperative learning in the teaching and learning process. For instance, the responses of the participants indicated that the one-way communication was replaced by teacher-learner and learner-learner interactions, the chorus responses by learners were replaced by individual responses, while the lecture or mass-teaching method was replaced by teacher responses that targeted a specific mistake or problem that the learner(s) displayed as they expressed themselves within the groups.

The implementation of cooperative learning was also visible in the two observations conducted in this study, which were a direct opposite of each other. In the first observation spell the teacher dominated the teaching and learning process, while the learners were passive in their rows. However, in the second observation spell the teaching and learning process was directed by the learners, with the teacher supporting the learners by correcting them and expanding their responses within the groups. Learner participation could have helped the teacher to quickly realise where learners misunderstood and help them accordingly. Yakovleva and Yakovlev (2014) noted that cooperative learning promotes continuous assessment, which occurs throughout the lesson. Therefore, the lack of classroom interaction implied that the learners' knowledge of the subject-matter was not tested during the lesson presentation, but this was done only during some summative assessment (e.g. weekly, monthly or quarterly).

Conclusion and recommendation

The study revealed that classroom interaction plays an important role in the participation of learners in the teaching and learning activities. The seating of learners in small groups was appropriate for big classes, as it helped the learners to participate in the discussions that occurred within the small groups – thus avoiding the mass teaching and learner passiveness that were experienced in the overcrowded classes. The study also showed that classroom interaction improved class/group control and teacher attitudes towards the teaching of EFAL.

The use of cooperative learning in the rural areas of Limpopo can go a long way in addressing the lack of classroom interaction in schools. Since cooperative learning requires no special equipment, it can be implemented with ease in the rural schools. In addition, the problems brought about by overcrowding are minimised since the learners are afforded opportunities to speak and to make inputs within their groups. In addition, classroom interaction also improves communication and socialisation within the groups.

It is recommended that cooperative learning be implemented, especially in overcrowded classes. This can be done by seating learners in groups of six, and then allowing a brief discussion among learner groups before an answer could be expected. The answer should include the input of all members of the group. The tasks to be allocated to groups have to be prepared in advance, with each group receiving, on paper, instructions and/or the task to be performed. In some cases, the tasks may be different for the different groups. For instance, different groups may be allocated different paragraphs to read and analyse, different questions to answer, and different words to build.

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SCIENCE CLASSROOM ENVIRONMENTS AS CORRELATES OF FEMALE STUDENTS' ACADEMIC PERFORMANCE IN BASIC SCIENCE IN ENUGU STATE, NIGERIA

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Abstract

This study investigated the relationship between the science classroom environment and the academic performance of female students in Basic Science. All the female students in Upper Basic Education in Enugu Education Zone in Enugu State, Nigeria were the population of the study. Three hundred JSII female students that were purposively selected from public secondary schools in the area of the study made up the sample for the study. One research question and one corresponding null hypothesis guided the study was guided by one research question and one null hypothesis. The null hypothesis was tested with Pearson Product Moment Correlation (PPMR) at 0.05 level of significance. The findings of the study indicated a positive correlation between the science classroom environment of female science students and their academic achievement was statistically significant. The recommendation made was that to improve the academic performance of students, funding used to improve the quality of the science classroom environment should be increased by the government.

Keywords: Academic Performance, Basic Science, Classroom Environment, Science

Introduction

Scientific skills, techniques, principles as well as values can be learned at the Lower, Middle, and Upper Basic Education Levels through science subjects like Basic Science. The subject is taught at the Lower Basic Education (primary 1-3), Middle Basic Education (primary 4-6), and Upper Basic Education (JSS 1-3) levels, respectively (NERDC, 2007). It is a prerequisite subject for choosing any career in science and technology as well as one of the core subjects for Basic Education. Basic Science is a subject that covers many disciplines and consists of concepts in Physics, Chemistry and Biology, etc. (Ani, 2021). Therefore, a student has to be proficient in Basic Science at the Upper Basic Education level, before he or she, can study single science subjects like Physics, Chemistry, and Biology at the Senior Secondary School level successfully. Hence, the Nigerian Education Programme which aims at advancing science and technology can be realized through Basic Science. Furthermore, to study any of the science and science-related courses in senior secondary school and higher institutions, Basic Science is one of the prerequisites. It is therefore required that a student should obtain at least, a credit in Basic Science in Basic Education Certificate Examination (BECE). Hence, for any student to qualify to read science courses at the secondary education level and courses like Medicine, Engineering, Industrial Chemistry, and various Applied Science courses in higher institutions, he or she is required to obtain at least, a credit in Basic Science in Basic Education Certificate Examination (BECE) (Obodo, Ani & Nebo, 2021).

The science classroom environment must be conducive to both teachers and students before the teaching and learning of Basic Science can be effective. Formal classroom systems exist in various citadels of learning, in developed or developing countries globally, depending on the type, shape, class, and academic environment in which they are situated. The

classroom which is a place where learners and teachers meet; is a miniature community in which members interact and influence the behaviour of others. It is found in educational institutions of all kinds, that include public and private schools, homes, schools, corporations as well as religious and humanitarian organizations (Onyeabor, 2019). Educational plans and research findings can be carried out and tried out in the classroom, which could also consist of an art gallery, museum, workshop, display center, or special room. The classroom can be seen as the powerhouse where The success or failure of the learning process is built and maintained in the classroom which serves as the engine room of knowledge. The classroom is the most important area in school and learning in the classroom Learning which requires a good level of concentration, listening, writing, and reading takes place in classrooms that range from small groups of five or six to big groups of hundreds of students that study in large classrooms called lecture halls. Gymnasiums for sports and science laboratories for Basic Science, Biology, Chemistry and Physics as well as labs that are used for IT lessons in schools, are examples of classrooms. The classrooms should be evaluated to meet Furthermore, the needs and challenges faced by education and environmental requirements for health, safety, and security should be assessed in line with classrooms (Lyon, 2001). Young (2014) is of the view that to facilitate students' learning, the classroom should be made comfortable and attractive. For lessons that require specific resources or vocational approaches, different types of classrooms Hence, both indoor and outdoor classrooms are used for lessons that require specific equipment or vocational techniques. Necessary learning aids such as a conducive school physical environment, well-painted classrooms, adequate chairs, reasonable distance from an industrial area for the prevention of unwanted noise as well as well-qualified and experienced teachers must be provided before effective teaching and learning processes can occur within the science classroom environment. Hence, there should be a conducive classroom environment, where there can be meaningful learning devoid of fear, stress, and tension in which the teacher and the students will be happy to stay and work.

That the teaching and learning process, can be made or marred by the classroom environment and is also an important motivating factor for teachers and students cannot be over-emphasized. Teachers are the curriculum implementers; they are saddled with the responsibility of implementing the curriculum or the content of the school syllabus mainly within the four walls of the classroom. The quality of teaching would probably affect the academic achievement of many secondary school students as well as learning programmes, which may be attributed to the state of the classroom environment. Furthermore, Adesua (2014), is of the view that learners, from different socio-economic backgrounds, come together to learn in the classroom environment which makes it an important, powerful, and effective instrument of socialization. According to Acero, et al. (2007), four factors make up a classroom environment: the physical environment, intellectual climate, social climate, and emotional climate. External elements that influence the learners such as the seating arrangement, ventilation, temperature, classroom size, instructional materials, visual lighting, orderliness, and cleanliness make up the physical environment. Provisions for activities that stimulate and develop the critical and creative thinking skills of the students, social climate, which is the interaction of the elements within the classroom such as the teacher and the students, consist of the intellectual climate, while the feeling of acceptance by the students within the classroom consists of the emotional climate (Acero, et al., 2007).

Every school has a climate that distinguishes it from other schools and influences the behaviour and feelings of teachers and students in that school (Ani, Metuh & Obodo, 2022). The classroom environment is very important in an educational circle. Classroom conditions that enhance teaching and learning, such as space, seat, air, equipment and other artificial situations that actualize effective teaching and learning are referred to as the Environment,

which is also seen as the addition of all the conditions that surround human beings within time and space. The physical aspect of the learner's environment which usually stimulate positive responses and represent the interests of those who live in it; is called learning space (Balog, 2018). Some factors which could affect the learning process include Intellectual factors such as the individual mental level (Mondal, 2012). Learning factors, due to faulty work or ineffective teaching techniques, as well as experimental background could affect the learning process. Health, physical development, nutrition, visual and physical defects, and glandular abnormality are also synonymous with Physical factors while Mental factors are tendencies like interest, cheerfulness, and open-mindedness that are indispensable in the development of human personality. Furthermore, motivation which is a complex psychological propensity is related to social factors, such as cooperation and rivalry as well as personal factors, like instincts and emotions. The teacher as an individual is an important factor in the learning environment. How the personality of the teacher interacts with the personalities of his students, determines the learning situation that emerges (Brown, 2015). The physical conditions needed for learning consist of Environmental factors like classrooms, textbooks, equipment, school supplies, instructional materials, and geographical location (Mondal, 2012).

The location within the school compound, the structure of their classroom, availability of instructional facilities and accessories determine the extent to which the learning of Basic Science students could be enhanced. Consequently, a school with a conducive learning environment contributes to improving expected outcomes of learning that will enhance good academic performance, by encouraging effective teaching and learning (Duruji et. al., 2014). Hence, learners deserve learning environments that meet their individual and collective needs. Educational Leaders must, therefore, provide physical and cultural environments that are empowering and engaging if they are to meet this challenge (Orlu, 2013). Urban schools as against schools in rural areas have differences in their educational conditions due to geographical location. Geographical location, therefore, influences academic achievement. In the view of Onainor and Obiora (2001), gender is another major factor that influences students' academic performance. Hence, the researchers maintain that boys performed better than their female counterparts in the different school subjects. The problem of poor academic achievement was attributed to psychological, sociological, psychosocial, and physical problems by Ani et al. (2021). Factors, like under-representation of females in science subjects: the inadequate opportunity for girls to study science, inadequate achievement of girls in science, girls lack of interest in science; negative attitude of female students to science learning and inadequate knowledge of female students on the true nature of science were identified by Fakorede, (1999) as cited in Nworgu, Ugwuanyi and Nworgu (2013) as contributing to under-representation of females in science subjects.

Researchers have carried out various studies on the relationship between classroom environment and students' academic achievement. For example, Afriani (2012) showed a significant correlation between classroom environment and the academic achievement of undergraduate students. Similarly, Ekundayo and Abubakar (2019) found a significant relationship between the academic performance of senior secondary school students and the classroom environment. Furthermore, Obi and Obi (2019), noted that the achievement of students in Chemistry is significantly contributed to by the classroom environment. Nwora (2008) found that the perceptions of students regarding their Chemistry classroom environment have no significant influence on their achievement in Chemistry but rather on the attitudes of students towards Chemistry. No significant relationship between the inherent characteristics of students and their academic performance was revealed by Iketaku, Ani and Onyia (2014). Ajayi (2007) revealed that the learning outcome of students is determined by the allocation of school facilities that is within the environment which is effectively utilized

and management. According to Ahmed (2003), the classroom is the origin of failure; nothing good can come out of most public secondary schools as they do not have facilities that are adequate and appropriate, to prepare students for the West African Senior School Certificate Examination. Hence, the gross failure experienced among senior secondary school students in the school certificate examinations is a result of the poor state of many public schools.

Effective teaching and learning of Basic Science is usually affected when the science classroom condition is not favourable. Where students are overpopulated, the teacher finds it difficult to correct and control the students, which results in poor science classroom management; which could degenerate into situations where students could fight and hurt themselves in the class. According to (Olagbemiro, 2010), factors, such as overcrowding in classrooms have usually been outlined as being responsible for the decline in the quality of education in Nigeria. Such facilities usually break down and deteriorate due to overuse and abuse. Some classrooms lack the necessary teaching/learning materials needed for effective teaching and learning, while others have structural defects like poorly ventilated windows; which give rise to poor learning outcomes that eventually result in poor academic performance by students. Students, according to Earthman (2002), receive more individual attention, ask more questions, participate more fully in discussions, reduce discipline problems and have better learning outcomes when they study in a conducive classroom environment that enhances the effectiveness of teachers. Hence, unless the science classroom environment of the nation's public schools changes for the better, the problem of student poor performance in Basic Science may continue. Therefore, we found it necessary to investigate the relationship between the academic performance of female Basic Science students and the science classroom environment by addressing the research question: What is the relationship between the academic performance of female Basic Science students and the science classroom environment?

Hypothesis

There is no significant relationship between the academic performance of female Basic Science students and the science classroom environment.

Methodology

The correlational research design was used to investigate the relationship that exists between the achievement of female Basic Science students and the classroom environment, in public secondary schools in Enugu Education Zone of Enugu State, Nigeria, Correlational research design seeks to establish what relationship exists between two or more variables (Nworgu, 2015). The population comprised all the Upper Basic Two (JSS II) female students in public secondary schools located in the three local government areas that constitute the education zone. The 300 female students in a public school were purposively selected for the study.

A modified secondary school science classroom environment (SSSCE) questionnaire that was originally constructed and validated by Frazer and Fisher (1983), was the main instrument used to collect data for the study. The instrument contains 45 items, in which a four-point Likert scale (Strongly Agreed (SA), Agreed (A), Disagreed (D), and Strongly Disagreed (SD)) was used. The questionnaire options were assigned nominal weighting, using 4 points, 3 points, 2 points, and 1 point respectively. The respective teachers submitted their students' last term scores in Basic Science, which were correlated with the students' responses to the questionnaire. Pearson product Moment Correlation (PPMR) was used to weigh, add and correlate these two scores and test the null hypothesis at 0.05 level of significance.

Results

To determine the degree of relationship that exists between science classroom environment and Basic Science scores of female students, the Pearson Product Moment Correlation Coefficient was used to provide an answer to the research question, that sought to determine the degree of relationship that exists between science classroom environment and Basic Science scores of female students. The percentage of variation in the Basic Science scores of female students was indicated by the coefficient of determination (r^2). Table 1 presents the result.

Table 1

Coefficient of Relationship Between Science Academic Performance and Science Classroom Environment

| Variables | N | Mean | SD | df | r | r ² |
|--------------------------------------|-----|-------|------|-----|------|----------------|
| Science Classroom Environment Scores | 300 | 31.20 | 4.25 | 298 | 0.69 | 0.48 |
| Basic Science Scores | 300 | 46.30 | 5.12 | | | |

The result in Table 1 shows a Pearson Product Moment Correlation Coefficient value r for science classroom environment and Basic Science scores was 0.69 indicating that there exists a positive relationship between science classroom environment and Basic Science scores of female students. The coefficient of determination of 0.48 indicates that 48% of the variation in Basic Science scores of female students is explained by changes in the science classroom environment.

Hypothesis 1: There is no significant relationship between the academic performance of female Basic Science students and the science classroom environment

To test the above hypothesis, scores relating to the science classroom environment and Basic Science scores of female students were correlated to obtain the Pearson Product Moment Correlation Coefficient, and the result is presented in Table 2.

Table 2

Performance Correlation Between Academic Performance and Science Classroom Environment Scores

| Variables | N | Mean | SD | df | r | r ² | Sig. | Decision |
|-------------------------------|-----|-------|------|-----|------|----------------|------|-------------------------|
| Science Classroom Environment | 300 | 31.20 | 4.25 | 298 | 0.69 | 0.48 | 0.00 | Rejected H ₀ |
| Basic Science Scores | 300 | 46.30 | 5.12 | | | | | |

Table 2 shows that there is a positive relationship between the science classroom environment and Basic Science scores of female students, $r(298) = 0.69$, $p = 0.00$. The analysis shows that the female Basic Science students on average obtained 31.20 out of 40% on their science classroom environment, and 46.30 out of 60% in their last term scores in Basic Science. Therefore, from the analysis above the result (r) is significant ($p < 0.05$), the null hypothesis is therefore rejected, and concluded that there is a significant relationship between the science classroom environment and the Basic Science scores of female students.

Discussions

The study found that there exists a positive relationship between the science classroom environment and the Basic Science scores of female students. The coefficient of determination of 0.48 indicates that 48% of the variation in Basic Science scores of female

students is explained by changes in the science classroom environment. This finding supports the works of Afriani (2012), Duruji and Oviasogie (2014), and Ekundayo and Abubakar (2019), who attest to the fact that if the classroom environment is in good condition and favourable, better performance of the students will be enhanced. The finding is similar to that obtained by Earthman (2002) in that a conducive and improved classroom environment, improves the effectiveness of teachers and provides students with prospects to interact one-on-one with them, ask more questions, participate more fully in discussions, reduce indiscipline and achieve better learning outcomes.

The result indicated that a significant relationship exists between the academic performance of female Basic Science students and the science classroom environment. This means that better performance of the female students will be assured if the science classroom environment is in good condition and favourable. This study corroborates the findings of Fraser (1996), and Ani, Metuh and Obodo (2022), who found that a significant relationship existed between school climate and pre-service teachers' performance in Tests and Measurement. This might have resulted in the fact that the school environment plays a major role in influencing and enhancing pre-service teachers' performance either, positively or negatively.

Conclusion and Recommendations

This study investigated the correlation between the science classroom environment and the academic performance of female students in Basic Science in the Enugu Education Zone in Enugu State, Nigeria. From the findings of this study, the researchers concluded that the science classroom environment was vital to the teaching and learning of Basic Science in Upper Basic Education since the academic performance of students in the termly examinations improved. The expectation is that those who scored highly or lowly in the science classroom environment are likely to replicate the performance in their Basic Science termly examinations. Hence, the science classroom environment that students were exposed to, affected their academic performance. A conducive classroom environment improved female students the academic performance of female students in Basic Science. was enhanced by a conducive classroom environment. The following recommendations were therefore made:

1. Government should invest more in the current status of the science classroom environment to enhance the academic achievement of Basic Science female students.
2. A conducive science classroom environment should be provided to enhance activity-based teaching and learning to realise positive academic outcomes in secondary schools.
3. Curriculum planners/developers in should put concerted efforts aimed at improving effective teaching and learning which should encourage the provision of a conducive learning environment.
4. There should be encouragement and motivation of teachers, as regards the attendance of Information Communication Technology (ICT) training, workshops, conferences and seminars, to update their knowledge, in line with innovations and current trends in teaching.

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GUIDANCE AND COUNSELLING PROGRAMMES OFFERED TO JUVENILE OFFENDERS IN A DEVELOPING COUNTRY

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Abstract

The study assessed the guidance and counselling programme offered to juvenile offenders detained in a developing country. The objectives were 1) to establish whether the guidance and counselling programme has achieved its goal and objectives, 2) to find out what knowledge and skills were acquired by the juvenile offenders from the guidance and counselling programme, and 3) to determine whether the behaviour patterns within the juvenile offenders have been improved because of the guidance and counselling programme. The guidance and counselling framework with aspects of family involvement and community support were used to discuss the findings. The case study design was used with a qualitative approach and using an interpretative paradigm. Purposive sampling was utilized to select ten juvenile offenders and two counsellors who were individually interviewed using a semi-structured interview guide. The data were thematically analysed, and ethics were considered. The findings revealed that the guidance and counselling programme helped juvenile offenders to recognize their talents and to remove undesirable traits. It was found that the juvenile offenders acquired soft skills that helped them to improve their behaviour while instilling discipline. It is noted that for the guidance and counselling programme to be successful, the involvement of all participating stakeholders is important.

Keywords: Guidance and counselling programme, Juvenile offenders, behaviour patterns.

Introduction

The guidance and counselling programme that is provided at the correctional institutions can successfully change the delinquent behaviours of juvenile offenders to improve behaviour patterns. Amat (2018) indicated that counselling is a proficient relationship concerning two or more individuals in which a counsellor supports clients in altering or resolving their individual matters. In this study counselling is used along with guidance as the support provided to individuals to try and assist them with their problems. The guidance and counselling is a programme that is targeting the juvenile offenders who are kept under custody in Eswatini, a developing country in Africa formerly known as Swaziland. The juvenile offenders are stated by Chakamba (2019) as youngsters below the age of eighteen (18) years, who have conflict with the law and therefore kept under the institutional custody for rehabilitation purposes. Juvenile offenders came into being because of the establishment of the security services after the western education system was introduced in Eswatini. The mandate of the security forces was to protect life and property and maintain social order and peace in the communities (Mabuza, 2019). In Eswatini, non-social behaviours such as theft, rape, assault are strongly opposed by community members as they protect their identity and dignity of their families, their clans, and even ethnic groups. Therefore, people who commit minor crimes would be made to pay fines while those who persist in committing crimes would be arrested by the police and put under custody and ultimately sentenced to jail where they would serve with hard labour as deterrent to the others (Sibisi, 2017). However, research has noted that some offenders continued to reoffend by

committing more crimes after their release from custody (Mabuza, 2019). This further happened with children who have offended and who continued to reoffend (Shabangu, 2021) in Eswatini. This is despite the corporal punishment that was used for a long time in trying to correct their behaviour, which would seem not to change at all. It is noted that even children who have not committed crimes but who display negative antisocial and naughty behaviour are commonly taken to the juvenile institution by their parents to attend school with juveniles and just for the institution to correct their behaviour (Shabangu, 2021).

Later in Eswatini, the guidance and counselling programme was introduced to all offenders and juvenile offenders alike (Shabangu, 2021). This came after the Convention of the Right of the Child (CRC) in 1990, which was ratified in Eswatini in 2012. The convention encouraged for the fair and humane treatment of juvenile offenders, emphasized the importance of the children's wellbeing and the rehabilitation of young people who conflict with the law. This study assessed the guidance and counselling programme offered to juvenile offenders to 1) establish whether the guidance and counselling programme has achieved its goal and objectives, 2) find out the knowledge and skills acquired by the juvenile offenders from the guidance and counselling programme, and 3) determine whether the behaviour patterns within the juvenile offenders have been improved because of the guidance and counselling programme offered to them. Suggestions for improvement of the programme are provided.

Literature Review

The study was conducted in one correctional institution in Eswatini that is characterized by juveniles who are orphans because of losing their parents due to AIDS-related illnesses. Most young offenders, including children, are vulnerable because of extreme poverty, the sickness of their parents, and abuse and exploitation subjected to them because of their home situation (mostly coming from polygamous families). As a result of these situations, several children do not complete their basic education, which results in the compound of delinquent behaviour and dropping out of school. Therefore, juvenile delinquency is on the rise in Eswatini. The juvenile offenders are then placed in rehabilitation schools with the goal of correcting and reforming their behaviour into well-adjusted, productive citizens (Shabangu, 2021). Teachers and correctional officers have relied on punishment to correct unruly offenders' behaviour, with beatings or caning being widely used. This has taken so long until recently, when the human rights agenda was globally adopted, which advocated for the human-rights-centred approach to juvenile justice. The correctional institutions in Eswatini changed the manner of treating juvenile offenders into a humane, holistic way by introducing the guidance and counselling programme.

Eliamani et al. (2014) indicated that guidance and counselling is assistance provided by qualified trained persons to an individual of any age to help them with life activities, develop their own points of view, and make their own decisions. This is like what Makhurane (2020) states that career guidance and rehabilitation counselling are provided to juveniles in some South African correctional institutions so that they can make better and more informed career choices and sustain their livelihoods without resorting to crime. Amat (2018) reports that in Malaysia, school counsellors provide counselling programs in areas such as academic, personal development, career, and drug prevention programs. In addition, the guidance and counselling programmes also provide support to help students resolve emotional and personal issues or behavioural problems (Amat, 2018). Similarly, the guidance and counselling offered in Malkern School in Eswatini was meant to improve the academic achievement of juvenile offenders, foster positive study habits and attitudes, increase the acquisition and application of conflict resolution skills, and decrease the number of school dropouts (Correctional Wheel, 2020).

In most African countries, Fasokun et al. (2005) state that guidance is provided by elderly or senior people in terms of their age and experience as they would be more informed in certain areas. Assisting other people is part of an obligation by the elderly or senior citizens. The latter members of the community help individuals with their daily challenges to life freely and regularly so that they can cope with life at different times and places, such as in families and other social gatherings or networks. This helping of other individuals has been part of the socialization process (Fasokun et al., 2005) as a lifelong endeavour that is performed out of goodwill. There is a proverb that says, "Experience is the best teacher." Hence, the people who provide guidance and counselling use their prior experience because they are knowledgeable and well-informed about many issues that might affect the individuals who may require their service. For instance, guidance about marital challenges in most African countries is still sought from couples who have been married for several years. It should be noted that in many developing countries in Africa, people who provide guidance and counselling do not attend any formal training since they rely on their experience that makes them experts regarding how they can assist those who are challenged in terms of how they can cope with life.

However, Thorpe et al. (2005) indicate counselling as a component of guidance, along with informing, advising, assessing, enabling, advocating, and feedback. This differs with what Knowles (1980) said about counselling that involves the programme planning process in many educational contexts, with steps such as: establishing a conducive environment for both the counsellor and client; assessing the needs and interests of individuals for further learning; helping them to formulate the learning objectives; and helping the individuals to continuously evaluate the progress towards their objectives. The example can be made with learners who may need advice about their career choices but still rely on guidance from education specialists because it is believed that they have the relevant knowledge and experience in education-related matters (Amat, 2018; Knowles, 1980). This could possibly differ with what some of the individuals might face in the current complicated situations that could require professionally trained people from various institutions, such as counsellors or social workers who work in various correctional institutions. Because guidance is all about facilitating informed decision making and choices, many correctional institutions rely on social workers to provide such guidance to incarcerated offenders, including juvenile offenders (Shabangu, 2021).

While guidance for juvenile offenders is provided by the social workers who are placed at the correctional institution (Shabangu, 2021), there are challenges with the social structure and a lack of appropriate resources and facilities in most African correctional institutions, thus rendering such services not as comprehensive as they should be (Ngozwana, 2017). These challenges could possibly affect the environment where counselling is taking place with the juvenile offenders in Eswatini. The question is, if guidance and counselling rely on someone with experience and knowledge about a phenomenon, who do juvenile offenders turn to for guidance while under custody? Is the guidance and counselling program provided to juvenile offenders using the experience of those who offer it? Is the programme achieving its goal?

Theoretical Framework

For this study the theory of cognitive development was utilized to explain how both cognitive and emotional skills develop (Wood et al. 2018) within young people, juvenile offenders in this case. Some studies have indicated that young persons involved in the criminal justice system have a higher likelihood of experiencing delayed cognitive development (Hodgkinson et al., 2021), which is supported by characteristics including poor emotional management and low academic achievement (Wolff & Baglivio 2017). A lack of

psychological resilience as a result, such as the inability to successfully overcome challenges, may result from this. Furthermore, reoffending rates and resilience are not necessarily correlated, making it difficult to determine how psychological growth, resilience, and decreased offending go hand in hand (Hodgkinson et al., 2021) especially if a person has been previously traumatised by arrest at a young age. Traumatic situations affect young people's cognitive development in a variety of ways. Studies show that these individuals frequently struggle to identify and describe their own emotions as well as those of others (Hodgkinson et al., 2021). Children and teens who offend have also been linked directly to delayed cognitive development, such as language impairment (Snow et al. 2015). In general, research shows that being exposed to trauma at a young age frequently causes higher levels of negative emotions like anger, higher levels of anxiety and sadness, and low levels of relatedness and self-concept, which may result in offending or reoffending (Gibson & Clarbour 2017).

The relevance of the environment and social role models for a person's learning, which may be of criminal behaviour, is emphasized by a different theory termed the Social Learning Theory (Bandura & McClelland 1977). According to this theory, individuals pick up any type of behaviour from one another through reciprocal observation, imitation, and modelling (Bandura & McClelland, 1977). As a result, by interacting with and imitating someone with a criminal history, another person can initiate and carry out illegal behaviours. A juvenile behaviour modification program that includes elements like academic enrichment programs, vocational training programs, and social development programs for juvenile offenders was explained using the social learning theory. Ubuntu, with its compassionate nature (Maphalala, 2017), helps better mould social workers' behaviours while interacting with young offenders since social connection facilitates social learning (Roberts & Hoseah, 2022; Mayaka & Truell, 2021).

Research Methodology

The study used a case study design with one correctional institution that keeps juvenile offenders in custody in Eswatini. This design was suitable for this study because it accommodated the people from whom the study focused on, who had the needed experience (Creswell, 2014), and the in-depth data was collected from them. Qualitative approach was employed as it enabled the juvenile offenders to express their opinions regarding how the guidance and counselling programme was achieving its goals (Rakotsoane, 2018). Two counsellors who are social workers were purposively chosen to participate in the study because of their knowledge about the guidance and counselling programme as the key informants. The counsellors are the ones who implement the guidance and counselling programme offered to the juvenile offenders in custody; therefore, they had the necessary experience to share. Furthermore, convenience sampling was used to reach them at the time of conducting the study, as they were available at the correctional institution because they were on duty. However, the data from the counsellors will be used sparingly but not presented fully in this paper because of limited space. Ten juvenile offenders who were learners at the same correctional institution were purposively chosen with the assistance of the counsellors who served as liaison personnel.

The data was collected using two semi-structured interview guides that were developed for counsellors and the juvenile offenders. Moreover, the interview conversations were held with counsellors at different times and on individual face to face using the SiSwati language to gather more information and allowing free expression of each one of them. Permission to record the conversations using a smartphone was granted by both counsellors. The data from the ten juvenile offenders was collected through one focus group discussion, which was held in the counselling office at the correctional institution and the SiSwati local

language was used. Likewise, permission to record the discussions was granted by the juvenile offenders. After the focus group discussion, two juveniles from the same group were further interviewed because they seemed quiet and with minimal participation in the group. The recordings were later transcribed into English for ease of reading and analysis. The data was analysed using qualitative thematic analysis as outlined by Braun and Clarke's six phase framework (Chakamba, 2019). The ethics of obtaining informed consent from all the participants was observed, along with assuring their confidentiality and anonymity, while also emphasizing their freedom to withdraw from participating at any time. Member checks were done for accuracy and common understanding between the participants and the researcher.

Findings

The findings are presented according to the three objectives that guided the study and the direct quotes are stated and infused as evidence to support the data.

Guidance and counselling programme achieving its goal and objectives.

The guidance and counselling programme for the juvenile offenders was reported to be educational, vocational, and psychosocial in nature for individuals and groups alike. The first, educational guidance, was meant to help the juveniles to choose the subjects that are of interest to them. This is what the first offender stated, *"I was able to choose the right subjects after I got help from the social worker."* The other type of the programme, which is vocational in nature assisted most juvenile offenders. In his own words, Juvenile Offender 03 said: *"I am glad that I now know how to design the furniture such as wardrobes, tables, chairs, coffee-tables, and shoe racks because of the help from the officers here. I am now selling my products and getting money, which I will use to establish my own business after my release from custody."*

For the psychosocial guidance and counselling, it came out clearly that such help is provided in groups and one offender 05 said, *"I am happy because I have learned to share my toiletries with others who do not get any family visits. I always share my bathing soap and Colgate with my two friends that I met here."* It could be noted that some offenders were able to develop social skills of sharing. Sharing is one of the African obligations as a person is a person through others. All the juvenile offenders mentioned that they have received advice from the social workers in various groups, in class, while they were eating or when they were in the dormitory where they sleep. This has reduced the programme to be only providing guidance, which is done publicly in a group, unlike the counselling that is mostly targeting individuals in a private and confidential setting.

Meanwhile counsellor 1 indicated that juvenile offenders usually visit the guidance and counselling office seeking advice and some just want away time. This response was supported by counsellor 2 who said, *"Learners come here for clearing their minds, some get the closure on some of the crimes they have committed."* When asked about how they provide guidance and counselling, both counsellors indicated that it depends on the learners' situation because they sometimes hold one on one sessions, or group sessions depending on the needs of their clients. The findings reveal that the counsellors provide needs-based guidance and counselling, unlike treating offenders as if they experience similar issues.

Knowledge and skills acquired by the juvenile offenders from the guidance and counselling programme.

Juvenile offenders indicated to have learned skills such as negotiation, communication, social, public speaking, quitting drugs, self-motivation, and peer pressure management. In his words, juvenile offender 06 stated, *"Out of many things that I have*

learned, I have seen myself able to make the right decisions by attending school." The other juvenile offender 02 said, *"I can manage peer pressure. Sometime before I came here, my friends would persuade me into doing things I hated to do, now I became strong because I am able to say no."* Juvenile offender 08 responded with a bit of emotions and said:

How I wish I met such a programme before I committed many mistakes that brought me here... I would not be here today [wiped tears and continued] ... but I am glad I got the opportunity to learn more about what life entails. When I get out of here, I will talk to others and teach them about life, especially about drug abuse and its consequences.

The excerpt from juvenile offender 08 above shows that he pledged to share his experiences with others to give them the knowledge he has acquired because of what he got from guidance and counselling programme. When responding to a follow up question where they were asked to describe the environment under which guidance and counselling took place, two juveniles indicated that the environment was unpleasant and disgusting, while the majority of eight said it was okay and they were happy about it.

Juvenile offenders' improvement in behaviour because of the guidance and counselling programme.

Some juvenile offenders revealed that the guidance and counselling was able to positively change their behaviour. For instance, juvenile offender 07 said *"I no longer use drugs because of the advice I got from the social workers"*. While juvenile offender 04 indicated that *"I am now focused on schoolwork because I now do my homework"*. Notably, juvenile offender 01 complained about the time allocated for the guidance and counselling sessions. In his words:

I feel that the time for the sessions is short, and I cannot just visit the counselling office at any time that I want to. One must wait for two weeks or more even if I have urgent issues. We are many in here, so we must wait because we all have different problems.

On a contrary, juvenile offenders 02 and 10 represented a negative attitude towards the programme. In all the questions that were asked in a group, they kept quiet. When interviewed alone after the group had dispersed, offender 02 kept saying he had no response. Counsellor 01 who had liaised to conduct the group session, asked him why he was not responding. He said he had nothing to say about the programme that he found there, that is not serving his interests as an offender. It was noted that he looked much older than the rest of the juveniles, again it could be that he never participated in the planning of the programme, which he may have felt that it does not meet his needs. This could imply that the juveniles were somehow socialised differently from their families than the rest of those who were participating freely. This assertion was supported by counsellor 01 who said, *"Some [juveniles] change their behaviour patterns because they regularly attend the sessions, but with others it is very difficult."* Similarly, counsellor 02 reported that *"The kind of learners [juveniles] we have in this school it is so difficult, no single programme can cater fully for their psychosocial needs. It depends on their cases and their willingness to change positively."* It is evident from the findings that the guidance and counselling programme does its intended mandate, however, it seems not enough to completely address the issues affecting the juvenile learners.

Discussion of Findings

Juvenile offenders in this study provided compelling information about the guidance and counselling programme in a developing nation. It is indicative from the study that the guidance and counselling programme has partially achieved its goal especially in assisting some juvenile offenders to choose their educational goals. This is in line with what Knowles (1980) postulate that in some educational programmes, amongst what the guidance and counselling programme does is to assess the needs and interests of individuals for further learning. For instance, juvenile offenders 03 and 05 reported to have acquired technical vocational skills due to attendance and guidance acquired from the counselling sessions. This finding confirms what Roberts and Hoseah (2022) found regarding a programme that equips offenders with academic and vocational skills and knowledge. On the same note the programme has instilled the African value of sharing to show caring. The findings revealed further that counselling and guidance programme provide the psychosocial support (Amat, 2018) as some juvenile offenders find closure about the crimes they had committed. This scenario illustrates findings by Fasokun et al. (2005) that talking to someone can provide the necessary support and guidance in a positive manner.

The findings revealed that some juvenile offenders acquired social skills that enabled them to make proper decisions because of attending the guidance and counselling programme, which supports what Amat (2018) found in Malaysia. This is shown in the reports by some juvenile offenders who indicated how they were able to resist peer pressure, while some reported to have improved their communication and others decided to attend school. This finding refutes assertions by Snow et al., (2015) and Hodgkinson et al. (2022) about young persons involved in the criminal justice system who experience delayed cognitive development. Instead, most juvenile offenders in Eswatini were rather showing signs of being resilient to their challenge, which showed positive cognitive development (Wood et al., 2018). This finding confirms what (Shabangu, 2021) found regarding the programme that equips juvenile learners with informed decision- making. Notably, the two juveniles with negative views about the guidance and counselling programme, could be experiencing the delayed cognitive development (Snow et al., 2015; Hodgkinson et al., 2022; Gibson & Clarbour, 2017) and persistent anger issues. Furthermore, some juvenile offenders' opinions regarding the filthy environment affirms assertions by Ngozwana (2017) who found that there was a lack of appropriate resources and facilities in most African correctional institutions.

In this study, some behaviour patterns within the juvenile offenders improved positively because of the guidance and counselling programme. This was evident from some juvenile offenders who reported that they refrained from using drugs, while others indicated that they were now able to do their schoolwork. This finding supports Eliamani et al. (2014), Makhurane (2020) and Shabangu (2021) that guidance and counselling programme helps individuals to develop their life skills, their own points of view and make own informed decisions. The improved behaviour change among some offenders could mean that offenders modelled their behaviour through socially interacting amongst themselves, which supports Bandura and McClelland (1977) social learning. The few offenders who showed non-social behaviour could imply that they had family issues and therefore, family counselling could have worked better in trying to modify their behaviour.

Conclusion

Based on the findings of this study, it can be concluded that the guidance and counselling programme is essential for the juvenile offenders to modify their behaviour and achieve their educational goals, vocational skills, and psychosocial wellbeing. Not only that, but juvenile offenders also reported the acquisition of social skills that enabled them to make

informed decisions, which helped them to positively improve their behaviours. However, it is imperative to ensure that juvenile offenders embrace the programme by getting them involved. This can be achieved if counsellors can assist them by emphasizing the benefits and values of guidance and counselling programme. It is recommended that counsellors should involve juvenile offenders early in the programme planning, to instil positive attitudes, thus reducing resistance and non-social behaviour towards the programme by few offenders. It is also recommended that counsellors should adopt ubuntu when dealing with juvenile offenders by going an extra mile to welcome, accept and show compassion towards them. Parental/Family intervention is encouraged in the provision of guidance and counselling of juvenile offenders. The importance of engaging all stakeholders such as family members, church ministers, teachers, and other community members in ensuring for a successful guidance and counselling programme cannot be overemphasized.

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EFFECTS OF MUSIC ASSISTED INSTRUCTION ON JUNIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT AND INTEREST IN BASIC SCIENCE AND TECHNOLOGY

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Abstract

Science and technology are the bedrocks for national development with peculiarities in pedagogy that require special attention at the foundation level in schools. This study explored empirically the effects of music assisted instruction (MAI) on junior secondary school students' achievement and interest in basic science and technology. A quasi-experimental research design was adopted for the study. Three hundred and fifteen Junior secondary school students from ten public schools in Abakaliki Education Zone of Ebonyi State, South-East, Nigeria were used. Two research questions and two hypotheses guided the study. Two validated instruments namely the Basic Science and Technology Achievement Test (BSTAT), and Basic Science and Technology Interest Inventory (BSTII) were used for data collection. The BSTAT has a reliability index of 0.88 as determined using Kuder-Richardson formular 20. While the BSTII has reliability index of 0.79 as determined using Cronbach Alpha method. Analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The study revealed among other things that there was a significant difference in the achievement mean scores of learners taught basic science and technology using MAI and learners taught basic science and technology using expository mode of instruction. Students taught using MAI did better than those taught using expository mode of instruction.

Keywords: Science achievement, Basic Science and Technology, Interest, Junior Secondary Schools, Music Assisted Instruction.

Introduction

Science and technology are two sides of a coin that propel the growth and development of any society. The level of sophistication attained by a nation in science and technology forms the yardstick for assessing a nation's socio-political greatness in the comity of nations (Igboanugo & Egolum, 2017). The importance of science and technology in nation building is globally recognized hence, many nations spend fortunes to pursue developments in science and technology through education (Matazu & Julius, 2017). Nigeria has undertaken a lot of curriculum developments and restructuring in science and technology in order to keep abreast with trends in global technological developments (Udoh & Jacob, 2016).

A foundation of science and technology education is laid in Nigeria through the subject, basic science and technology. Basic science and technology is an integrating subject that presents the holistic nature and the interconnectivity of science and technology to the learner. The subject is offered as a core curriculum at the basic education level (Federal Republic of Nigeria [FRN], 2013). Nigeria introduced the present basic science and technology curriculum at the basic education level to suit the global needs and aspirations of the millennium development goals (Ahmed et al., 2017). Basic education comprises of six years in primary school and three years in junior secondary school (JSS). At the end of the three year JSS education, the learner goes into senior secondary education where science and

technology are separated and each resolved into some subjects for further studies and career developments. Such subjects include biology, chemistry, and physics. Thus, the foundation for knowledge acquisition and career development in science and technology education is basically laid through instruction in basic science and technology.

At different parts of the globe including the United States of America, Nigeria, Kenya, Indonesia, researchers attest to learners' continuous loss of interest in science and technology subjects/courses at the different levels of education (Akram et al., 2017; Busola, 2011; Igboanugo, 2021; Widinda, 2017). This could be as a result of poor foundation laid in science and technology at the basic education level. Hassan et al. (2016) assert that learners begin to lose interest and achieve poorly in science and technology even at the foundation class of secondary school.

Lack of interest and poor achievement in basic science and technology usually makes learners in early stages to drop from pursuing science and oriented courses and careers. This implies that the aspirations of the learners, parents, and society for some science and oriented careers such as engineering, medicine and agriculture cannot be met. Some of the causes of lack of interest and poor academic achievement in science and technology at schools include: shortage of science and technology teachers, lack of teaching resources and equipment, large class size, teachers' poor attitudes and qualifications, use of ineffective modes of instruction, and irrelevance of curriculum contents to the learners' needs (Danjuma & Nwagbo, 2013-2017; Igboanugo & Okonkwo, 2020; Njoku, 2020).

The mode of instruction which is the vehicle through which the teacher presents learning experiences to the learner determines in a great measure the extent to which the learning objectives will be realized. The ancient Greek adage which says "I hear and I forget; I see and I remember; I do and I understand" affirms to the different effects of different modes/strategies of presenting the learning experiences to the learner. Strategies of instruction that appeal to the learner tend to be more effective. Tsakeni (2020) asserts that many nations across the globe lack adequate training in pedagogy for science and technology teachers. This can lead to teachers' lack of innovation and non-proficiency in the use of effective modes of instruction.

The expository mode of instruction adopted by most teachers in Nigeria and other African nations mar the interest and understanding of young science learners, and causes poor academic achievement in sciences (Igboanugo, 2020; Njoku, 2020; Uko & Uko, 2020). This is because the expository mode of instruction renders the learner passive and, in most cases, does not consider the learner's personality. On the other hand, the use of modes of instruction which actively involve the learner captures their interest, boosts their understanding, and can always result in high academic achievement (Igboanugo, 2021). It takes the science and technology teacher an innovation and creativity to implement modes of instruction that can efficaciously improve learners' interest and achievement in science and technology. Such efficacious modes of instruction should be learner-centred (FRN, 2013). One of the ways of involving the young learner in basic science and technology instruction could be through careful inclusion of music that actively engages the learner during instruction.

Music is vocal or instrumental sounds or both combined in such a way as to produce beauty or form, harmony and expression of emotion. The use of music in instruction is referred to as MAI. Music is part of most peoples' culture across the globe. Consequently, adoption of MAI in basic science and technology is tantamount to adopting instructional strategy that is cultural based (Akpoghol et al., 2016). The cultural based instructions have been proved to be efficacious in delivering science and technology lessons (Uko & Uko, 2020). Thus, MAI connects the young learner from his/her home experience to the present classroom experience thereby ensuring continuity in the learner's cognition and daily learning experiences. Besides, as cultural based instruction, the MAI is capable of adding

social and home experiences to lessons in science and technology for easy adaptation (Piaget, 1936).

Researchers such as Besedova et al. (2019) and Nadelson et al. (2020), enumerated that the use of MAI in the classroom helps with learners' motivation, content alignment and classroom management. Other uses are development of the pupils' personality, development of learners' emotional intelligence, positive influence of learner's aesthetic emotions and helps them to build ethical basis of their personality, attitudes and opinions.

Music-assisted instruction is rooted in the learning theory of social constructivism in which learning is supported by authentic environments and social interactions (Vygotsky, 1978). MAI can engender group work among learners by lending them common voice and spirit of oneness to pursue a given task(s), and getting them inspired to work together for accomplishment of a given goal(s) and meeting specified target(s). Thus, MAI can promote healthy cooperation and teamwork in the science and technology class which has been confirmed to be very effective in realization of science and technology lesson specific objectives (Ibe, 2016; Igboanugo, 2014).

The basic science and technology teacher who adopts MAI makes the lesson to be music centred by adding song or using the content to compose a song to be sung in the class. For instance, in teaching the first 20 elements, the names of the first 20 elements can be used to compose a song to be sung showing the order of their placement in the periodic table which can give indelible message to the young learner about the names, and the atomic numbers of the elements. This is capable of involving every learner with excitement and captures/builds the learner's interest. The teacher does not need special training or musical skill to compose the music for MAI. The teacher can involve the learner in composition of the song, download the music from the internet or involve an expert (Akpoghol et al., 2016).

MAI can be used ante instruction, in situ, and post-instruction. In the ante instruction use, the teacher gives the learner a recorded version of the music for instruction to play/practice before the scheduled classroom lesson. With the in situ use of the MAI, the learner plays/practices the music during the classroom lesson. The post-instruction use of MAI is the play/practice of the music by the learner after the classroom lesson. The ante instruction, in situ and post instruction uses of MAI make it a 24-hour package instructional strategy. The ante instruction use of MAI also renders it fit for virtual and e-learning instructions. The use of MAI might be time consuming but has socio-cultural and psychological leverages that might improve learner's interest and achievement in basic science and technology. However, Besedova et al. (2019) and Nadelson et al. (2020) report that teachers are reluctant in using MAI in teaching.

The important question for this study is: Can MAI improve learner's interest and achievement in basic science and technology? Empirical study on the effects of music assisted instruction in basic science and technology might yield useful results that would encourage teachers of basic science and technology and other stake holders to be more innovative and proactive in adopting and using better strategies for improving learners' interest and achievement in science and technology.

Statement the Problem

Basic science and technology is the foundation for solid science and technology. Without solid science and technology the nation's overall development will be slow. Extant literature reveals consistent low levels of learners' interest and poor academic achievement in science and technology (WAEC chief examiners' reports in chemistry, 2018, 2019 and 2020; WAEC chief examiners' reports in physics, 2018, 2019 and 2020). This is a serious threat to nation building and sustainable development. Use of mode of instructions that can ensure

students' active participation in the science and technology lesson is capable of alleviating the low interest and poor academic achievement in science and technology.

The study was conducted in Abakaliki Education Zone of Ebonyi State, South-East of Nigeria. Learners' achievement and interest in junior secondary school basic science in this area has been observed by the researchers to be poor. The content area used was elements taught in junior secondary school 2. Two songs composed by the research with music teacher assistance were used to teach the first twenty elements. One tagged 'names of the elements' and another tagged 'symbols of the elements'.

Purpose of the Study

The purpose of this study was to determine whether there would be differences in achievement and interest among students depending on method of instruction

Research Question

The study was guided by the following research questions:

- i. Is there a difference in achievement of learners taught basic science and technology using MAI and those taught using expository mode of instruction?
- ii. Is there a difference in interest of learners taught basic science and technology using MAI and those taught using expository mode of instruction?

Hypotheses

The study's hypotheses were that:

1. There will be a significant difference between the achievement mean scores of learners taught basic science and technology using MAI and learners taught basic science and technology using expository mode of instruction.
2. There will be a significant difference between the interest mean scores of learners taught basic science and technology using MAI and learners taught basic science and technology using expository mode of instruction.

Methodology

A quasi-experimental design was adopted for this study. Specifically, the pretest post-test nonequivalent control group design was used for the study. The design is represented thus:

$$\begin{array}{c} \text{O}_b \text{ X O}_a \\ \text{O}_b \sim \text{X O}_a \end{array}$$

X= Treatment (The MAI)

~X = Control (Expository mode of instruction)

O_b = Pretest measurement

O_a = Post-test measurement

Population and Sample

The population of the study comprised all the 2020-2021 Junior Secondary School 2 (JSS2) basic science learners in Abakaliki Education zone of Ebonyi state, South-East, Nigeria. A sample of 315 JSS2 basic science and technology learners from ten schools selected by simple random sampling from the 67 public secondary schools in the zone was used in the study. Treatment and control groups were assigned to the schools at random. Five schools were assigned to the treatment group and the remaining five schools were assigned to the control group.

Instruments for Data Collection

Two instruments constructed by the researcher, namely the Basic Science and Technology Achievement Test (BSTAT) and Basic Science and Technology Interest Inventory (BSTII) were used for data collection in this study. The BSTAT was a 20-item, 4-option multiple choice objective test covering elements as recommended in the JSSII basic science and technology curriculum (FME, 2007). The options were lettered a, b, c, d with one option being the correct response while others were distracters.

The BSTII was made up of 15 items that covered students' interest in basic science and technology. It was a four-point scale. Each item has the options of, strongly agree, agree, disagree and strongly disagree.

Validity and Reliability

The BSTAT comprising twenty-two (22) items and the BSTII comprising fifteen (15) items were face validated by two experts in science education, one expert in music education, one expert in measurement and evaluation, and one junior secondary school teacher. Their contributions which suggested outright removal of two items from the BSTAT brought the number of items to twenty also. Contributions of the experts helped to ensure that each of the items in the two instruments was understandable and relevant to the study. Content validity of the BSTAT was assured by using the test blueprint to ensure that all aspects of the content were covered. The test blueprint was constructed by considering the number of periods to cover each concept and level of objectives of each concept. Eight (8) items covered names of elements while twelve (12) items covered symbols of elements.

The instruments were trial tested on forty (40) junior secondary school 2 students of a school from Afikpo Education Zone, a different Education zone from the zone of the study. The trial test helped to improve the quality of the test items and confirm the face validity of the items. Furthermore, from the result of the trial test, reliability index of the BSTAT was determined using Kuder-Richardson formular 20 to be 0.88 while reliability index of the BSTII was found to be 0.79 using Cronbach Alpha method. This was considered an acceptable reliability index (William, 2015).

Experimental Procedure and Data Collection

Permission to conduct the study was sought from the principals in the selected schools. Information about the study was provided in the form of a cover letter. After permission was granted, the researcher established protocols with the teachers. The regular basic science and technology teachers in the treatment group were trained and used as research assistants, who helped to carry out teaching in their respective schools. The teachers were trained for two weeks to conform strictly to the MAI lesson plan as prepared by the researcher. Assistance of a music teacher was involved in training of the teachers. A song for the MAI used in the treatment group was composed using the names of the first twenty elements in other of their placement in the periodic table. Another song for the MAI used in the treatment group was composed using the symbols of the first twenty elements. For the control group, the regular basic science teachers taught in their respective schools using the usual expository teaching method. The topic, element was taught in both the treatment group and control group. Pretests were administered to the subjects using the BSTAT and BSTII. Scores were obtained and recorded by the researcher before the experiment commenced. The experiment was carried out during normal school hours using the school timetable for the classes. The experiment lasted for four weeks. On the last day of the experiment, a post-test was administered to the subjects using the BSTAT and BSTII. Scores were obtained and recorded by the researcher. The BSTAT and BSTII used in the post-test were the same in content with the BSTAT and BSTII used in the pretest but differed in the sequence of items.

Method of Analysis

The data collected from the pretest and post-test were analyzed using SPSS version 25 and the results obtained used to answer the research questions and test the hypothesis for the study. The research questions were answered using mean score and standard deviation. The hypotheses were tested at a significant level of 0.05 using analysis of covariance (ANCOVA).

Results

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

Research Question 1: Is there a difference in achievement of learners taught basic science and technology using MAI and those taught using expository mode of instruction?

Table 1: Achievement Descriptive Statistics

| Groups | Pretest | | Post-test | | Gain mean score | Number of subjects |
|----------------------|---------|---------|-----------|---------|-----------------|--------------------|
| | Mean | Std Dev | Mean | Std Dev | | |
| Experimental (MAI) | 17.67 | 7.28 | 88.38 | 7.79 | 70.71 | 160 |
| Control (Expository) | 30.40 | 11.13 | 55.47 | 10.61 | 25.07 | 155 |

Table1 shows that learners taught basic science and technology using the MAI had achievement mean score of 17.67 on the pretest with a standard deviation of 7.28 and 88.38 achievement mean score on the post-test with a standard deviation of 7.79. The gain mean score for the MAI group is 70.71. Learners taught using the expository mode of instruction had an achievement mean score of 30.40 on the pretest with a standard deviation of 11.13 and 55.47 achievement mean score on the post-test with a standard deviation of 10.61. The gain mean score for the expository group is 25.07. To know whether the higher gain mean score of the group taught basic science and technology using the MAI, over the group taught basic science and technology using expository mode of instruction was significant, the null hypothesis, H_{01} was tested at significant level of $p < 0.05$.

Research Question 2: Is there a difference in interest of learners taught basic science and technology using MAI and those taught using expository mode of instruction?

Table 2: Interest Descriptive Statistics

| Groups | Pretest | | Post-test | | Gain mean score | Number of subjects |
|----------------------|---------|---------|-----------|---------|-----------------|--------------------|
| | Mean | Std Dev | Mean | Std Dev | | |
| Experimental (MAI) | 59.21 | 3.42 | 92.05 | 10.42 | 32.84 | 160 |
| Control (Expository) | 72.94 | 13.81 | 73.77 | 12.40 | 0.83 | 155 |

The results presented in Table 2 show that learners who were taught basic science and technology using the MAI had interest mean score of 59.21 on the pretest with standard deviation of 3.42 and 92.05 interest mean score on the post-test with standard deviation of 10.42. The gain mean score for the MAI group is 32.84. Learners who were taught basic science and technology taught using the expository mode of instruction had interest mean score of 72.94 in the pretest with standard deviation of 13.81 and 73.77 interest mean score on the post-test with standard deviation of 12.40. The gain mean score for the expository group is 0.83. With a higher gain mean score in the group taught using the MAI, it seemed that use

of the MAI might be more effective in improving learner's interest in basic science and technology than use of the expository mode of instruction.

Hypothesis 1: There is a significant difference between the achievement mean scores of learners taught basic science and technology using MAI and learners taught basic science and technology using expository mode of instruction.

Table 3: Summary of Analysis of Covariance for Achievement

| Source | Type III Squares | Sum of Df | Mean Square | F | sig. |
|---------------------|---------------------|--------------|-------------|-------|------|
| Pretest Achievement | 89.71 | 1 | 89.71 | .62 | .432 |
| Method | 76758.76 | 1 | 76758.76 | 59.54 | .000 |
| Error | 44210.49 | 310 | 144.95 | | |
| Total | 1246065.00 | 315 | | | |

Table 3 shows that the null hypothesis of no significant difference between the achievement mean scores of learners taught basic science and technology using MAI and learners taught basic science and technology using expository mode of instruction was rejected ($F(1,310)=59.54, p<.001$).

Hypothesis 2: There is a significant difference between the interest mean scores of learners taught basic science and technology using MAI and learners taught basic science and technology using expository mode of instruction.

Table 4: Summary of Analysis of Covariance for Interest

| Source | Type III Squares | Sum of Df | Mean Square | F | sig. |
|------------------|---------------------|--------------|-------------|-------|------|
| Pretest Interest | 19.98 | 1 | 19.98 | .15 | .702 |
| Method | 10187.37 | 1 | 10187.37 | 74.67 | .000 |
| Error | 41609.36 | 310 | 136.42 | | |
| Total | 2009060.0 | 315 | | | |

Table 4 shows that the null hypothesis of no significant difference between the interest mean scores of learners taught basic science and technology using MAI and learners taught basic science and technology using expository mode of instruction was rejected ($F(1,310)=74.67, p<.001$).

Discussion

The results of this study showed that students who were exposed to MAI tended to score higher than on both achievement and interest of learners in basic science and technology. These results are presented in Tables 3 and 4. The results of this study are in consonance with Akpoghol et al. (2016) who reported that the lecture method supplemented with music improved the students' academic achievement in electrochemistry. Music has culture undertones which makes MAI learner-centred. The learner-centredness of MAI may make the learner to be keenly involved and participate more in learning. This also is consistent with Igboanugo (2020) who found out that learner centered mode of instruction is efficacious in improving learners' achievement in chemistry.

MAI is potentially capable of building the spirit of cooperation among learners which helps in cross fertilization of knowledge and ideas among learners. Learners learn better through peer interaction which is a condition enabled by the MAI. This is in consonance with Igboanugo (2014) and Ibe (2016) who maintain that cooperation among learners in science and technology improves academic achievement. MAI links the classroom experience to the

socio-cultural experience of the learner for meaningful learning and elimination of abstractness. This can boost learners' enthusiasm for learning and thereby improves understanding and achievement in basic science and technology. This confirms the learning theory of social constructivism which maintains that learning is supported by authentic environments and social interactions (Vygotsky, 1978). This finding also conforms to Uko and Uko (2020) who assert that culturally based instruction is efficacious in improving learner's achievement in science and technology.

Recommendations

Based on the findings of this study, there is potential for students to have increased interest in learning through the use of methods that are engaging (such as MAI), and thus teachers may want to consider exploring methods that are student centered, and which foster more student participation and interaction.

Conclusion

Appropriate mode of instruction aids improvement in learners' understanding and interest in science and technology for improved achievement. This study has succeeded in exploring the effects of music-assisted instruction (MAI) on junior secondary school students' achievement and interest in basic science and technology. The MAI was found to significantly improve the learners' achievement and interest in basic science and technology. The MAI has cultural instinct and promotes cooperation among the learners. It has the advantage of being used for both the classroom and virtual/e-learning instructions thereby rendering itself for twenty-four hour instruction. Furthermore, it creates room for individualized instruction and takes care of students who may be slow. This study is an eye opener to teachers of science and technology to possibly turn to the use of MAI for effective pedagogy.

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STUDENTS PERSPECTIVES ON THE ROLES OF E-LEARNING PLATFORMS IN ACHIEVING EFFECTIVE TEACHING AND LEARNING OF SCIENCE EDUCATION

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Abstract

This study's aim was to investigate how well science education is taught and learned in secondary schools in Enugu, South-East Nigeria, using e-learning platforms. Three research questions and three null hypotheses were developed for the study in order to accomplish the target of the research. For the investigation, a descriptive survey design was chosen. South-east Nigeria is where the study was carried out. In the Enugu education zone, there were 4,145 senior secondary school two (SS2) students. The sample size for the study was 50 SS 2. Questionnaire that was properly validated and trial tested was used for data collection. Data collected were analysed using mean and standard deviation. The study's findings demonstrated the important roles that e-learning tools like WhatsApp, Zoom, and Google Classroom play in accomplishing effective science teaching and learning. Therefore, it was advised that Google Classroom, Zoom, and WhatsApp be used to teach science courses.

Keywords: E-learning platform, Teaching and learning, effective teaching

Introduction

Education can be learned at home and in a school environment. Situations may arise that cause the students to leave the school environment. Despite such circumstances, it is expected that learning should never stop. Therefore, in order to keep learning going, e-learning must be adapted and put to effective use. As a result, this study will delve deeper into students' perceptions of the role of e-learning platforms in effective science teaching and learning. The study will be taken in order as follows: background of the study, purpose of the study, research questions, hypothesis, literature review, theoretical framework, methodology, and results.

Background of the Study

In 2019, the Centres for Disease Control and Prevention (CDC) started tracking the SARS-COV-2 pandemic, a new coronavirus that causes the respiratory condition known as COVID-19 (United Nations Educational Scientific and Cultural Organization, 2020). The COVID-19 coronavirus has caused havoc on the global educational system, causing the majority of nations to temporarily close all educational institutions in an effort to stop the epidemic's spread. According to a UNESCO report (2020), educational institution closures have touched approximately 91 percent of the world's student population. Educators and students at elementary, secondary, colleges, and universities have been affected by the pandemic's ripple effect, as academic sessions have been postponed since the coronavirus was declared a public health emergency. The COVID-19 epidemic has brought attention to the value of online education and distant learning, yet only a small portion of education worldwide is provided online.

But E-learning is not a new notion in the field of education. E-learning did not emerge from anywhere but was synchronized and accepted as a result of the worldwide pandemic known as Covid-19. The emergence of COVID-19, on the other hand, has increased the demand for schools to use technology platforms to support online teaching and learning efforts. Innovation has become a crucial life skill in today's educational environment. Innovation's creative flame is creativity. As a result, e-learning platforms arose from creativity education and have since evolved into the essence of future education. Developing talents in e-teaching platforms has become an important goal of educational reform and economic development for all countries in the world (Lee, 2011). Our educational system is being altered by the roles of e-learning platforms for teaching and learning. Due to high-speed internet and technological innovation, classroom teaching training days are gradually decreasing. The epidemic has increased the worldwide importance of e-learning.

The pandemic prevented students from attending classes in many countries, including Nigeria. The epidemic's effect on education has had a negative effect on parents, students, the country, and the world in general. Olatunji (2020) estimates that 15% of all undergraduate students in the United States are enrolled in online or distance learning courses. Schools without access to an online learning environment have been more severely impacted by the epidemic.

Numerous economic sectors have been severely damaged by the global COVID-19 pandemic, especially in Nigeria. This impact may also be seen in the Nigerian educational system, where the Federal Ministry of Education halted classes to stop the virus from spreading to schools. Some educational institutions were shocked by this action because they weren't ready for the sudden disruption, but others saw it as a positive step. It therefore becomes unclear how this pandemic might affect students and academic schedules, which is why e-learning is being employed as a substitute for traditional classroom instruction.

Online information distribution is referred to as e-learning. It involves fusing education with technology (Okure, 2018). It is instruction that is transmitted exclusively digitally, using CD-ROM, the internet, and private networks (Landon, 2010). Additionally, Hedge and Hayward (2014) described e-learning as a creative way to use the internet and digital technologies while paying attention to the principles of instructional design to provide electronically mediated, well-designed, learner-centered, and interactive learning environments to anyone, anywhere, at any time. Operationally, e-learning is the process of learning that occurs between a student and teacher over the internet while utilizing digital technologies. The type of computer system or program being used is referred to as the "platform." Knowledge is transferred from teachers to students during the process of teaching and learning. It is defined as a process in which an educator defines and establishes learning objectives, develops teaching resources, and implements a teaching and learning method. Therefore, in order to actualize the teaching and learning of science, the role of e-learning platform is of great importance.

The digital tools are available on the internet network, and the e-learning platforms are digital media-based technology. Educators and students alike benefit from the accessibility of e-learning platforms. Teachers' and students' daily lives have been revolutionized by e-learning platforms (Ouadoud et al., 2016). According to research, using an e-learning platform improves students' attitudes toward homework and its value in the educational process (Benta et al., 2014). During the COVID-19 lockdown, e-learning platforms proved to be extremely beneficial to students and teachers, as many institutions relied on them for remote education. The e-learning sector has enormous potential, with estimates that it will be worth \$ 243 billion by 2022 (Marry, 2018). These e-learning platforms include the following Blackboard, DigitalChalk, Moodle, Sakai, Canvas, Educadium, Thinkific, Skillshare, TED-Ed, Codeacademy, Alison, Peer 2 Peer University, WhatsApp teaching, Zoom cloud,

teleconferencing, Google classroom, edmodo, teleconferencing, teaching through radio programs, teaching through television, text message-based instruction, teaching through e-mail, among others.

The utilization of diverse e-teaching platforms stems from the fact that different topics and abilities need to be taught and developed. Educators created many e-teaching platforms with the goal of incorporating students more in the teaching-learning process. This is considered very important and there is a need to get these platforms into the classrooms (Oyelekan et al., 2017). Teachers must not only be aware of these platforms but also learn how to use them responsibly in the classroom if this is to be accomplished successfully. A teacher who is unaware of the various platforms available cannot attempt to use them in the first place, let alone use them correctly. Students can connect with words, symbols, and ideas using e-learning platforms in ways that improve their reading, listening, problem-solving, watching, thinking, speaking, writing, and media and technology skills.

The benefits of e-learning platforms for efficient teaching and learning have been the subject of numerous research. The use of e-learning platforms has a statistically significant impact on learners' interests in learning, according to Onyema et al. (2020). E-learning platforms have a significant impact on students' academic achievement, especially for those who have access to electronic tools and media that are employed in the teaching/learning process, according to a different study by Cathrine and Edward (2022). According to Fidanboyly (2014), the usage of visual aids in the classroom can inspire pupils and strengthen the subject matter. Due to a dearth of empirical data in the domain of this study, this study decides to contribute to the conversation by identifying the roles of e-learning platforms in attaining scientific teaching and learning in secondary schools in Enugu State.

Purpose of the Study

This study examined the roles of e-learning platforms in achieving effective teaching and learning of science education in secondary schools in Enugu state. The specific objectives were:

1. To examine the roles of the WhatsApp e-learning platform in achieving effective teaching and learning of science education.
2. To find out the roles of zoom cloud learning-learning platform in achieving effective teaching and learning of science education.
3. To ascertain the roles of Google classroom learning-learning platforms in achieving effective teaching and learning of science education.

Research Questions

The objectives of this study were achieved by considering the following research questions.

1. What are the roles of WhatsApp learning-learning platform in achieving effective teaching and learning of science education?
2. What are the roles of Zoom cloud learning-learning platform in achieving effective teaching and learning of science education?
3. What are the roles of Google classroom learning-learning platform in achieving effective teaching and learning of science education?

Hypotheses

The following hypotheses were raised to guide the study.

1. The mean ratings of students' response on the roles of WhatsApp e-learning platform in achieving effective teaching and learning of science education do not differ significantly.
2. The mean ratings of students' response on the roles of zoom cloud e-learning platform in achieving effective teaching and learning of science education do not differ significantly.

3. The mean ratings of students' response on the roles of Google classroom e-learning platform in achieving effective teaching and learning of science education do not differ significantly

Literature Review

In order to learn amid the crisis, online e-learning is essential. Additionally, maintaining the technical infrastructure properly is necessary for success in colleges and universities (Nikdel Teymori & Fardin, 2020). Examining the strengths, weaknesses, opportunities, and threats of online learning, Dhawan, 2020 (SWOT). He demonstrates how the global crisis emphasizes the importance of technology proficiency in managing the situation and promoting learning. Schools should therefore teach kids the required IT skills. In Malaysia, a different study was done to see how satisfied male and female students were with using e-learning portals. He discovered a strong correlation between user pleasure and online e-learning. The quality of the e-learning platforms and the information given determine both participants' satisfaction levels (Shahzad et al., 2020).

Methodology

Research Design

The descriptive survey research design was used for the investigation. The descriptive study design is a scientific method that entails observing and describing a subject's behavior without interfering with it in any manner. The goal of a descriptive design, according to Aggarwal and Ranganathan (2019), was to describe the distribution of one or more variables without regard for any causal or other hypotheses. This design was employed by Nassaji (2015) and Navarro-Patón et al. (2020) in their research, and they discovered that it was suitable for documenting unaltered occurrences. Because more information is required to comprehensively characterize how e-teaching platforms would contribute to effective scientific teaching and learning in secondary schools in Enugu State, the descriptive research approach was chosen.

Area of the Study

The Enugu Education Zone in Enugu State served as the study's location. One of Nigeria's 36 States, Enugu State is made of seventeen (17) Local Government Areas as its administrative center. The Nigerian state of Enugu is situated in the country's South-East geopolitical region. The six education zones that make up Enugu State are: Enugu, Nsukka, Agbani, Awgu, Obollo-Afor, and Udi. The Enugu education zone will serve as the only focus of this investigation. The three (3) local government areas of Enugu East, Enugu North, and Isi-uzo make up the Enugu education zone. There are thirty-one (31) secondary schools in the Enugu education zone. The reasons for choosing this area are based on the fact that the schools have not learnt using e-learning platforms as a tool in achieving effective teaching and learning of science education.

Population of the Study

The population of this research comprised all secondary school students in Enugu Education Zone in Enugu State. There are three (3) Local Government Areas under Enugu Education Zone and thirty-one senior secondary schools in Enugu State. From the thirty-one (31) senior secondary schools, there are 4,145 senior secondary schools (SS2) students, 1,435 males and 2,710 females in Enugu education zone. Based on this research, the population of the study will be limited to Enugu East local government area which consists of ten (10) senior secondary schools, 561 males and 1,092 females bringing to a total of 1,653 senior secondary schools (SS2) students.

Participants

Twenty-five (25) male and twenty-five (25) female senior secondary school students from Enugu East in Enugu State made up the study's sample of fifty (50) students. The responders of the survey were seniors in high schools. The respondents were selected using a straightforward random sampling method.

Measure and its validity

A thirty (30) item self-structured questionnaire titled "Role of E-learning Platforms in Achieving Effective Teaching and Learning of Science Education" was the study's main tool (REPAETLSE). The questionnaire was split into three (3) sections A, B and C. Section A discusses the respondents' social demographic characteristics, whereas Section B focuses on the variables of the predictors, and Section C on the variables of the criterion. A modified Likert 4-point rating scale of Strongly Agree (SA) = 4points, Agree (A) = 3points, Disagree (D) = 2points, and Strongly Disagree (SD) = 1point was used for rating the questionnaire. The questionnaire was distributed to the fifty (50) respondents sampled for the study.

The research professionals at the Faculty of Education at the University of Nigeria Nsukka subjected the research instrument to face and content validation. These specialists were asked to assess the instrument in terms of the research questions, the language employed in its development, and the scope of the material. Suggestions and comments made by these experts were used to reduce the ambiguity of some items. These comments and suggestions will be incorporated into the final draft of the instrument.

To ascertain the consistency of the instrument, the test-retest reliability method was adopted. The instrument was administered to ten (10) students outside the study sample. In two (2) weeks interval, the same instrument was re-administered to the same group of students. The reliability test of the two (2) scores was done with the aid of SPSS software. The result showed a reliability score of 0.506 was obtained.

Administration of the Instrument

Fifty (50) copies of the structured questionnaire were administered to the respondents by the researchers and three (3) research assistants. After administering the instrument, the researchers and the research assistants collected the data for further processing and analysis.

Ethical Statement

The researchers were granted ethical approval to conduct this research by the researchers' university committee on research ethics. Besides, the participants were served with informed consent forms to fill and sign before the commencement of the experiment.

Method of Data Analysis

In presenting and analysing collected data, mean and standard deviation were used and t-test was used to test the hypotheses at 5% probability level.

Results

Research Question One: What are the roles of WhatsApp e-learning platform in achieving effective teaching and learning of science education?

Table 1: Mean analysis of the ratings of the respondents on the roles of WhatsApp e-learning platform in achieving effective teaching and learning of science education

| Item Statement | Std. | | Remark |
|----------------|------|-----------|--------|
| | Mean | Deviation | |

| | | | |
|--|--------------|-------------|--------------|
| 1. WhatsApp e-learning platform makes teaching and learning very interesting. | 3.16 | .88 | Agree |
| 2. WhatsApp e-learning platform motivates students to learn effectively | 2.86 | 1.15 | Agree |
| 3. WhatsApp e-learning platform encourages critical thinking. | 2.58 | 1.17 | Agree |
| 4. WhatsApp e-learning platform enhance students' confidence and intelligence. | 2.44 | 1.14 | Agree |
| 5. WhatsApp e-learning platform enhances students' retentive memory. | 2.82 | 1.00 | Agree |
| 6. WhatsApp e-learning platform enhances student creativity and usage of electronic device. | 3.14 | .85 | Agree |
| 7. WhatsApp e-learning platform makes students active learners | 2.42 | 1.08 | Agree |
| 8. Using WhatsApp e-learning platform will allow me to accomplish more work than would otherwise be possible | 2.74 | 1.06 | Agree |
| 9. WhatsApp e-learning platform teaches students how to share documents with other electronics tool similar to WhatsApp. | 3.50 | .73 | Agree |
| 10. WhatsApp e-learning platform encourages personal learning | 3.60 | .72 | Agree |
| Overall Mean | 28.06 | 4.79 | Agree |

Table 1 shows that the mean ratings of the respondents on items 1 to 10 are more than the 2.50 benchmark mean. This implies that the respondents agreed to the statements of the items as the roles of WhatsApp e-learning platform in achieving effective teaching and learning of science education.

Research Question Two: What are the roles of zoom cloud e- learning platform in achieving effective teaching and learning of science education?

Table 2: Mean analysis of the ratings of the respondents on the roles of zoom e-learning platform in achieving effective teaching and learning of science education

| Item Statement | Mean | Std. Deviation | Remark |
|--|------|----------------|--------|
| 11. Zoom cloud e-learning platform helps students to be discipline while on camera. | 3.04 | .85 | Agree |
| 12. Zoom cloud e-learning platform keeps memory of concept fresh in student for a long time. | 2.96 | .85 | Agree |
| 13. Zoom cloud e-learning platform will enhance students comportment on camera. | 3.26 | .75 | Agree |
| 14. Zoom cloud e-learning platform enhances effective teaching, and learning | 2.64 | 1.04 | Agree |
| 15. Zoom cloud e-learning platform inspires students to be more practical and research oriented. | 3.08 | .98 | Agree |
| 16. Zoom cloud e-learning platform enhances students observatory, critical thinking, and attentive skills. | 3.20 | .83 | Agree |
| 17. Zoom cloud e-learning platform can be a distraction to students during teaching and learning. | 2.62 | .98 | Agree |

| | | | |
|---|--------------|-------------|--------------|
| 18. Zoom cloud e-learning platform boost competition among students. | 3.08 | 1.08 | Agree |
| 19. Zoom cloud e-learning platform encourages students' ability to ask questions during learning. | 3.10 | 1.03 | Agree |
| 20. Zoom cloud e-learning platform encourages students in studying their books. | 2.32 | 1.11 | Agree |
| Overall Mean | 29.30 | 3.78 | Agree |

Table 2 shows that the mean ratings of the respondents on items 11 to 20 are more than the 2.50 benchmark mean. This implies that the respondents agreed to the statements of the items as the roles of zoom e-learning platform in achieving effective teaching and learning of science education.

Research Question Three: What are the roles of Google classroom e-learning platform in achieving effective teaching and learning of science education?

Table 3: Mean analysis of the ratings of the respondents on the roles of google classroom e-learning platform in achieving effective teaching and learning of science education

| Item Statement | Std. | | Remark |
|--|--------------|-------------|--------------|
| | Mean | Deviation | |
| 21. Google classroom e- learning platform makes teaching and learning concise and less time consuming. | 3.36 | .82 | Agree |
| 22. Google classroom e- learning platform prepares students to be future online tutor. | 3.20 | .80 | Agree |
| 23. Google classroom e- learning platform makes evaluation easy for the teachers | 2.96 | .83 | Agree |
| 24. Google classroom e- learning platform helps students to do their assignments at ease. | 3.24 | .89 | Agree |
| 25. Google classroom e- learning platform allows collaboration between teacher and students | 2.90 | .99 | Agree |
| 26. Discussions on e-learning platform technologies are uninteresting. | 2.68 | 1.13 | Agree |
| 27. Google classroom e- learning platform enhances student's creativity and ideas. | 3.32 | .79 | Agree |
| 28. Google classroom e- learning platform gives elaborate content coverage to students. | 2.82 | .98 | Agree |
| 29. Google classroom e- learning platform is student-centered. | 2.80 | 1.04 | Agree |
| 30. Google classroom e- learning platform increases participation of students during teaching. | 3.10 | .95 | Agree |
| Overall Mean | 29.88 | 3.50 | Agree |

Table 3 shows that the mean ratings of the respondents on items 21 to 30 are more than the 2.50 benchmark mean. This implies that the respondents agreed to the statements of the items as the roles of google classroom e-learning platform in achieving effective teaching and learning of science education.

Discussion

The data analysis in table 1 indicated that WhatsApp e-learning platform plays a role in achieving effective teaching and learning of science education. The study also revealed that the majority of the students agreed to the items from 1-10 that WhatsApp e-learning

platforms plays a role in achieving effective used in teaching and learning of science education. This is in agreement of Catharine and Edward (2022) that e-teaching platforms have great influence on students' academic performance especially for those who have access to electronic tools and media that are used in the teaching/learning process. The study also answered the research hypothesis 1. From the result indicated in Table 4, the mean rating between the male and the female has no much difference between them. The data analysis in Table 2 indicated that Zoom e-learning platform plays a role in achieving effective teaching and learning of science education. The study also revealed that the majority of the students agreed to the items from 1-10 that Zoom e-learning platforms plays a role in achieving effective teaching and learning of science education. The study also answered the research hypothesis 2.

From the result indicated in Table 5, there was not much difference between mean rating between the males and the females. Although the result did not agree to Onyema et al. (2020) who found out that the use of e-learning platforms had a statistically significant effects on the learning interests. The data analysis in Table 3 indicated that Google classroom e-learning platform plays a role in achieving effective teaching and learning of science education. The study also revealed that the majority of the students agreed to the items from 1-10 that Zoom e-learning platforms plays a role in achieving effective used in teaching and learning of science education. The study also answered the research hypothesis 3. From the result indicated in Table 6, the mean rating between the male and the female has no much difference between them. This shows that teachers make use of these e-learning platforms in achieving teaching and learning of science education. Contrary to what Bada and Jita (2012) found in their study on e-learning facilities for teaching secondary school physics: awareness, availability, and utilization, physics teachers are aware of the majority of these facilities, but only a small number of them are readily accessible for teaching physics. The study by Bada and Jita (2012) also showed that only one of these e-learning resources—a desktop computer—was used by secondary school physics teachers. As a result, the authors came to the conclusion that e-learning resources were not employed in Ondo to teach secondary school physics. The digital tools are accessed through the internet network and are embedded into the e-learning platforms using digital media technology. E-learning platforms' accessibility benefits both teachers and students. Platforms for online learning have changed both teachers' and students' daily lives (Ouadoud et al., 2016). Using an online learning environment helps children understand the importance of homework and how crucial it is to their education, according to studies (Benta et al., 2014).

Because many institutions used them for remote education during the COVID-19 lockdown, e-learning systems proven to be quite beneficial for both students and teachers. The adoption of various e-teaching platforms is driven by the need to teach and develop diverse skills and topics. Teachers created a range of e-teaching platforms to involve students more in the teaching-learning process. These platforms must be introduced into classrooms since they are regarded to be extremely important (Oyelekan et al., 2017). According to Fidanboyly (2014), the utilization of visual aids in the classroom can excite children and reinforce the subject matter. Teachers must not just be aware of these platforms but also know how to successfully use them in the classroom if this is to be done.

Conclusion and Recommendations

The above findings point to the fact that e-learning platforms are platforms that can transform education into high-level academic achievements if educational stakeholders, governments, and proprietors will encourage the use of e-learning platforms in teaching. Some studies have made recommendations, but the government agencies have not taken any action. The findings of this current study, therefore, implicate the government policy on the

use of e-learning platforms in achieving effective teaching and learning of science education in Nigeria. This implies that the Nigerian government needs to expedite action on e-learning platforms and education policy statements on the active intervention strategies to engage students, principals, proprietors and stakeholders. We, therefore, recommended that:

1. Nigerian government, non-governmental organizations, the education system, and local governments should also take responsibility for the actualization of the use of e-learning platforms across all the tertiary, secondary and colleges in the country.
2. Non-government organizations need to design appropriate orientation programs for students, principals, and proprietors for active engagement in the e-learning platform's usage.
3. The education system itself through the help of various education stakeholders needs to fashion out education campaign programs that can propagate the use of e-learning platforms in education.
4. At the local government level, efforts should be made by the area and zonal inspectors of education in ensuring that e-learning platforms are properly intimated toward providing effective teaching and learning of science education.
5. we recommended that parents should be allowed to be part and parcel of the decision-making process of their children's school activities. These will assist in motivating them to use online learning environments to educate their kids.

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RECONNECTING LIFE SKILLS TEACHER'S TEACHING PRACTICES DURING THE POST- COVID -19 PANDEMIC

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Abstract

The focus of this paper was on reconnecting Life Skills teachers' teaching practices during the post-Covid 19 pandemic. The aim was to understand how teachers adapt and transform the challenge caused by the pandemic which had no pre-configured guidelines for appropriate teaching and learning practices to be employed. The 2019 Coronavirus pandemic triggered significant changes in the education system worldwide including institutions of Higher Education programs that need teachers to redo, acquaint and align their practices with the curriculum. The paper was informed by an analytical framework to examine teachers' teaching practices in classrooms along the Activity Theory (AT) dimensions. The strength of AT lies in its ability to enable researchers to understand learning as the complex result of tool-mediated interactions. The paper was rooted in an interpretive paradigm using a qualitative approach and a case study design. Data were collected from three purposively selected Life Skills teachers through interviews, observations, and document analysis. Content analysis guided the data analysis through themes that were derived from the subsidiary questions and coded for easy referencing. Findings revealed that teachers demonstrate inadequate knowledge about the use of different practices, and they were struggling because of the effects of technological challenges. The paper recommends that the Department of Education should organise professional development workshops to equip Life Skills teachers with technological skills.

Keywords: Life Skills; Mediate; Practices, Corona Virus, Teaching

Introduction

The focus of this paper was on reconnecting Life Skills teachers' teaching practices during the post-COVID 19 pandemic. The research was carried out in 3 rural schools in the Dutywa District of the Eastern Cape Province, South Africa. It has been reported that during COVID-19 pandemic many countries suspended standardised testing programmes, which are the most powerful tools for securing equity, fairness, and meritocracy in education (UNESCO, 2020). Some countries did not even resume high-school tests during the following school year (World Bank, 2021). COVID-19 left as many as 1.5 billion students out of school in early 2020 because there was a global consensus that education systems in too many countries were not delivering the quality education needed to ensure that all have the skills necessary to thrive (World Bank, 2021). This was caused by the lack of knowledge that hinder teachers from using different practices as they were technologically challenged (Biesta, 2019). It is essential for teachers to be professionally developed on how to connect their teaching practices during lesson presentations, specifically Life Skills teachers. The aim of this study was to understand how teachers adapt and transform the challenge caused by the pandemic which had no pre-configured guidelines for appropriate teaching and learning practices to be employed (Nash, 2020).

COVID-19 is the first global pandemic in recent times, to disrupt higher education institutes (HEIs) and the experience has certainly been challenging for both academics and students (World Health Organisation (WHO), 2020). For example, lack of direct interaction

with learners, changing in teaching practices, and sudden change in setting was among those that most strongly affected teaching and learning (Petzold, 2020). Teachers were struggling with using different approaches introduced, such as online platforms, and alternating face-face interaction (Petzold, 2020). It is, therefore, essential to understanding the reconnection of teachers' teaching practices prior to and during post- COVID-19 pandemic. This is done to be better prepared for subsequent disruptions caused to HEIs and to understand how this pandemic has shaped the Life Skills curriculum (White & Van Der Boor, 2020). Life Skills, as a subject, is an integrative subject and has a cross-cutting nature which develops learners holistically and enables them to take informed decisions about their lives (Department of Education, DoE, 2010).

Challenges experienced during COVID-19 pandemic led to the shifting of teaching and learning practices used in teaching, including Life Skills subject (Cloete, 2020). Some teachers and students could have been affected by these challenges and that resulted in compromise and a shift from face-to-face teaching to online (hybrid). Nonetheless, the challenges presented by the transition do not only affect Life Skills teachers' teaching practices, but all the academic staff, many of whom needed higher levels of technology competency (Nash, 2020). Life Skills teachers had to adapt and transform the challenges caused by the pandemic which had no pre-figured guidelines for appropriate practices to be employed (Pretorious, 2021). Gillett-Swan (2020) reported that teachers suffered as they were unable to interact with learners and attend in-person classes to use their teaching practices and strategies properly.

The transition presented challenges for not only Life Skills teachers teaching practices, but all the academic staff, many of whom needed higher levels of technology competency (Soudien, 2020). Life Skills teachers had to adapt and transform the challenges caused by the pandemic which had no pre-figured guidelines for appropriate practices to be employed (Nash, 2015). From this perspective, not only Life Skills teachers supposed to reconnect their teaching practices in order to recover from the disrupted time caused by the COVID-19 pandemic, but all teachers need to engage in this activity. The aim was to understand how teachers adapt and transform the challenge caused by the pandemic which had no pre-configured guidelines for appropriate teaching and learning practices to be employed.

In Italy, Barron (2021) conducted a study with a special focus on teachers and how they had to quickly reimagine human connections and interactions to facilitate learning during post-COVID-19 pandemic. He claimed that teachers could be adaptable and resilient in their practices during lesson presentations. Findings revealed that teachers are imagining themselves preparing their materials ready to be used in their classrooms although they were complaining of some challenges encountered before. Amongst other challenges mentioned by teachers was the inadequate use of the online platform. Murphy (2020) argued that the transfer to online education has challenged teachers' teaching practices.

Teachers suffered as they could not interact with learners and attend in-person classes to use their teaching practices and strategies properly (Gillett-Swan, 2020). To power up schools after COVID-19, using technology to improve teaching and learning is important to support teachers on the comparative advantages of technology (Margaliot, 2020). Without involving and supporting educators in innovation, efforts will not be sustainable over time.

Another study in Europe by Filiz and Konukman (2020) focussed on teaching strategies of Physical Education teachers' practices during the COVID-19 pandemic. Their aim was to find out what practices were used by teachers to teach Physical Education during the time of the pandemic because the nature of Physical Education involves many people performing different indoor and outdoor activities. Findings revealed that it was not easy for

both teachers and learners to perform physical education activities because it needs a ventilated space. Thus, during this time, teaching and performing activities were impossible. Therefore, during post-COVID-19 pandemic Life Skills teachers are expected to reconnect their teaching practices.

In Chile, before and after the COVID-19 pandemic, teachers were working together to rapidly lend their expertise to develop relevant remote-learning content for students (Wang and Wei, 2020). A network of teachers came together to develop a series of 30-minute radio lessons for secondary students who had no access to online learning. The radio lessons were scheduled to go from being distributed by a handful to over 240 radio stations per month after the school closure. Findings revealed that although students enjoyed and benefited from listening to lessons on the radio, others were complaining of network problems that hindered them from benefiting from the content.

Similarly in the United Kingdom, Oak National Academy has been a significant feature of the government's remote learning strategy for developing online classrooms and resource hubs. The Academy was used by a group of teachers concerned about learning continuity for their students when schools were closed due to COVID-19. It emerged that the Academy developed within two weeks and helped educators and parents to help their children learn during the COVID-19 crisis.

In South Africa, Ndzimande (2021) put forth five proposed actions for teachers to seize the moment of COVID-19 pandemic today to transform education systems to better serve all students, especially the most disadvantaged HE institutions. The minister urged teachers to use different practices to improve the poor conditions caused by the pandemic. Despite the efforts made by the Department of Education (2019) to sustain learning and teaching during the pandemic, for example, online and face-face platforms, the 2019 Coronavirus pandemic continues to trigger significant changes in the education system worldwide, including HEI programs (UNESCO, 2020). Ndzimande (2021), the Minister of Higher Education in South Africa, came up with various interventions to deal with education-related challenges before and after the pandemic. These include the recovery of Annual Teaching Plans (ATPs) released through Circular S13 of 2021, which aimed at supporting the recovery of learning and ensuring authentic deep learning. These remained the official teaching plans for all institutions, but some teachers are still struggling to reconnect their teaching practices effectively, even to date (Petzold, 2020). In support, teachers need to redo, acquaint and reconnect their practices with the curriculum using the tools provided by the Department of Education.

While the above-mentioned studies have contributed to the study of reconnecting Life Skills teaching practices during the post-COVID-19 pandemic, none of the studies has focused on what is being done, especially during the post-COVID-19 pandemic circumstances. Thus, our paper is unique in the sense that it argues for the reconnection of Life Skills teachers' teaching practices. Considering this, the aim of this paper is to discuss the reconnection of teaching practices that could be employed during the post-COVID pandemic.

To achieve the objective of this paper, researchers asked the following questions:

1. How do teachers reconnect their Life Skills teaching practices during the post-COVID-19 pandemic?
2. What strategies could be employed to reconnect teaching practices during the post-COVID-19 pandemic?

Theoretical Framework

This paper was informed by the Cultural Historical Activity Theory (CHAT), to collect, analyse and explain the data (Engestrom, 1987). The researchers found the second

generation of CHAT, also known as Activity Theory (AT) relevant, as a methodological framework to think about the process of making meaning and learning in a social context. CHAT was therefore used in this paper to understand how Life Skills teachers reconnect their teaching practices during the post-COVID-19 pandemic as actions in an activity are mediated by a 'complex network' of socio-historical activities. We understood that Life Skills teachers' teaching practices involved interactions with their students using available tools to mediate all the activities performed as a community in Life Skills classrooms during lesson presentations (Engestrom, 1987).

Thus, the goal of teachers during post-COVID-19 is to ensure that they are mediating teaching and learning using tools to reconnect their practices effectively. However, this does not mean that there are no challenges caused by this pandemic and other ways of communication. Some people, including teachers and students are still complaining about the consequences.

This paper makes an original contribution to knowledge by combining the existing teachers' teaching practices with empirical research using interviews, observations, and documents to collect and analyse data.

Research Methodology

The research design for this paper is a descriptive and interpretive case study that is analysed through qualitative methods. This is qualitative research in which the case study was used as views and feelings of teachers about the reconnection of their teaching practices in Life Skills subject during Covid-19 pandemic were important to be discovered (Flick, 2014). Interviews were used to evaluate and determine teachers' levels to reconnect their practices during the COVID-19 pandemic. Document analysis, structured observation, and semi-structured interviews were used as data collection methods through the understanding of the theoretical framework components CHAT, such as tools, subjects, and objects set in the social context of rules, community, and division of labour (Engestrom, 1987). The data was conserved in descriptive narrations like field notes and recordings. According to (Krauss, 2018), qualitative research is interesting in both unintended and intended consequences since it shows determination to identify the phenomenon.

Permission to conduct the study was granted by the Provincial Department of Education, Dutywa Education District, and the principals of the sampled institutions. An ethical clearance certificate was issued, and the agreed participants signed the informed consent forms as they were guaranteed their confidentiality and anonymity, pseudonyms used were Teacher 1A, Teacher 2B, and Teacher 3C.

According to Creswell (2013) population is a set of individuals, events, or objects that share common characteristics and represent the whole or some total of cases involved in a study. The population for this paper comprised six Bachelor of Education (BEd) Foundation Phase (FP) level two Life Skills teachers from six selected schools. The sample of three teachers was then purposively selected from the schools of Dutywa Education District in the Eastern Cape Province, South Africa. The purposive sampling was used to select information-rich individuals as the sample was judged to be typical of the population under investigation and less generalised (Mouton, 2012).

Regarding ethical considerations, participants were assured that their identities would not be revealed. We also informed them that their participation was voluntary and that they could withdraw at any time.

Qualitative data through document analysis, semi-structured interviews and structured observation were generated from the three BEd FP level two Life Skills teachers of three Higher Institutions in the rural area. The data was collected through the CHAT components of the theoretical framework as it offers tools to collect and analyse. For instance, the tools,

subjects, and objects set in the social context of rules, community, and division of labour in an engaging activity in goal-oriented actions to the attainment of the object mediated by tools through the interactions of both the teacher and learners as the community (Engestrom, 1987).

Appropriate level two Life Skills documents, for example, teachers' guide, lesson plans, student module guide, and Life Skills policy document were analysed with the aim of checking the Life Skills guidelines relevance. According to Cohen, Mannion, and Morrison (2017) document analysis refers to the technique of making inferences by objectively and systematically identifying specified characteristics of messages in documents. Document analysis was the point of departure data for this paper. This provided a picture of Life Skills teachers reconnecting their teaching practices during post-COVID-19 pandemic.

In choosing the structured observation, the main issues were not pre-empted but allowed to emerge as the process evolved. Structured observation afforded us an opportunity to gather "live activities" from 'live situations' and enabled us to understand the context of programmes and discovered information not mentioned in interviews (Best & Kahn, 2013). In this paper, we observed the interactions of both Life Skills teachers and learners during lesson presentation reconnecting their practices using tools to mediate teaching and learning in classrooms. From an activity theory perspective, researchers need to observe situations in which participants are engaging in goal-directed actions and object-oriented activities relevant to the paper (Askew, 2010; Engestrom, 1987).

We used semi-structured interviews to generate most of the data to understand teachers' strategies in using Learning and Teaching Support Materials (LTSM) to mediate teaching and learning in classrooms. The semi-structured interviews were used as they are flexible, allowing new questions to be brought up during the interview as a result of what the interviewee says (van der Mescht, 2014) as the case in this study. Interviews were recorded and field notes were taken. Interviews were conducted at the schools where participants felt comfortable. Questions were constructed with CHAT in mind. The purpose was to use the aspects of the activity system to make sense of the practices in the system. Finally, in order to ensure trustworthiness of the paper, appropriate criteria of credibility, transferability, dependability and confirmability were considered. Responses were transcribed after completion (Kalpesh, 2013). The researchers retained all transcribed recordings for safekeeping so that the written responses could be used to validate the data.

Data Analysis and Procedures

All the collected data were studied and analysed to unlock the hidden information from raw data and transform it into user-friendly and if any themes have emerged (Kalpesh, 2013). During the process of data analysis, we tried to retain the voice and sense of originality and fully depended on what was revealed from the elements of CHAT. All the key elements were discussed as they relate to what was done (Engeström, 1987). "CHAT aims to understand individual human beings, as well as the social entities they compose in their natural everyday life circumstances, through an analysis of the genesis, structure, and purpose of their activities" (Kaptelinin, 2016, p.3). The aim of the researchers was to create descriptive, multidimensional categories, which form a preliminary framework for analysis. Data were coded, units and categories were identified, and patterns were recognised. The data were grouped into an explication of themes and sub-themes and coded (Leedy, 2021). Data were analysed thematically.

Findings

The following are the themes that emerged, and are discussed in this paper:

- Technological challenges

- Inadequate knowledge about the use of different practices

The findings are presented and discussed according to the following themes that emerged as outlined above.

Technological Challenges

All the interviewed participants presented how they are using different practices to reconnect their understanding on Life Skills during COVID-19 pandemic. Teachers argued that they were using the same practices that they used before as they were comfortable and understood them better. Life Skills teachers had to adapt and transform the challenges caused by the pandemic which had no pre-figured guidelines for appropriate practices to be employed (Nash, 2015).

Teachers were worried because the institution was introducing new tools that were not used before and that resulted in some of them lacking knowledge on how to them. They should align their teaching with the new materials used now although they did not attend any workshops before. It was not easy to align their practices with the curriculum at the time because had changed and was linked with the new tools. This confused them and they were unsure about appropriate teaching method to use. Teachers were struggling with using different approaches introduced, such as online platforms, and alternating face-to-face interaction (Petzold, 2020). Life Skills subject needs different teaching practices because of its nature of having indoor and outdoor activities to be performed. Therefore, one should have knowledge on how to use different teaching practices. During this time, it will be easy to carry out indoor activities because COVID-19 pandemic restrictions have been amended. Nevertheless, this allows teachers to connect using any kind of teaching practice easy although during COVID-19 this was not easy because of network challenges and poor attendance of students.

I prefer to use the same teaching practices that I used before the COVID-19 (Teacher 1A)

I am worried because the institution is introducing new tools that were not used before and that results in some of them lacking knowledge on how to them). We should align our teaching practices with the new materials used now although we did not attend any workshops before although it is not easy to avoid confusion (Teacher 2B).

If we can attend organised workshops, one should have gain knowledge on how to use different teaching practices more especially during this time it will be easy to carry indoor activities because COVID-19 pandemic restrictions have been amended.

Nevertheless, this allows me to connect using any kind of teaching practice easy although during COVID-19 this was not easy because of network challenges and poor attendance of students (Teacher 3C).

It became known from Life Skills teachers that they preferred to the same practices that they were using before as they are comfortable and understood them better. Teachers were worried as the institution is introducing new tools that were not used before and that result in some of them lacking knowledge on how to them. They argued that aligning their teaching practices with the new materials specified in the curriculum before attending workshops is not easy as workshops could equip them with more knowledge. Margalio (2020) states that to power up schools after COVID-19, using technology to improve teaching and learning is important to support teachers on the comparative advantages of technology. This makes one to become confused and not clear about which appropriate

teaching method to use. Life Skills teachers hoped that during post-COVID-19 pandemic they will be able to reconnect their teaching practices because the restrictions have been amended. although they are facing network problems and students' poor attendance.

Inadequate Knowledge About the use of Different Practices

All the interviewed participants agreed that they preferred to use the collaborative method as one of the transformative strategies. Wang and Wei (2020) argue that teachers that are working together could rapidly develop their expertise. Also, working in groups affords teachers time to reflect on how some activities should be done during the planning of lessons. This method enables them to share their understanding and ideas that could manage them to reconnect their Life Skills teaching practices during the COVID-19 pandemic using the technological tools available. One teacher was complaining of being computer illiterate because she does not have enough knowledge on how to perform activities. They wish to attend computer workshops to be developed to gain more knowledge and computer skills. Biesta (2019) contends that it is essential for teachers to be professionally developed on how to connect their teaching practices during lesson presentations, specifically Life Skills teachers.

Teachers were worried as the institution was introducing many platforms simultaneously to be used. Their Information Technology Department is changing the use of computers for teaching every time. In fact, the Department is not giving them enough time to understand at least the easiest method to be employed. One participant was complaining of her age that it is contributing hence there were no computers used before, as a result, they prefer to use the traditional approach, especially this time. If teachers can be allowed to use one teaching tool for a long time that could make them pleased and the problem of lacking knowledge on how to use different teaching practices could be overcome.

I prefer to use the collaborative method as one of the transformative strategies especially that Life Skills is an integrative subject across all other subjects. Working in groups assist us to change ideas as one could learn from one another how to reconnect teaching practices during this time (Teacher 1A).

I do not have enough knowledge on how to use different teaching practices because I am computer illiterate. I am unable to perform activities. Infact, the Department is not giving them enough time to understand at least the easiest method to be employed (Teacher 2B).

During this time, I prefer to use a traditional approach. This approach allows me to use different practices during lesson presentations. If we can be allowed to use one teaching tool for so long, I can be pleased, the problem of lacking knowledge on how to use different teaching practices could be overcome (Teacher 3C).

It transpired from the interviewees during interviews that working in groups is the best-recommended practice as they were comfortable with changing their ideas to overcome inadequate knowledge to use different teaching practices. The minister urged teachers to use different practices to improve the poor conditions caused by the pandemic (Ndzimande, 2021). It was also highlighted that if teachers can be allowed to use one teaching tool for so long that can make them pleased, the problem of lacking knowledge on how to use different teaching practices could be overcome.

Discussion of Findings

Several facts emerged from this study of reconnecting Life Skills teachers teaching practices during the COVID-19 pandemic. The main issues that were highlighted include the effects of technological challenges and inadequate knowledge about the use of different practices. It was revealed that Life Skills teachers were struggling to reconnect their teaching practices because they were computer illiterate and that resulted in some using the traditional method as they were comfortable and familiar with it. Life Skills teachers had to adapt and transform the challenges caused by the pandemic which had no pre-figured guidelines for appropriate practices to be employed (Pretorius, 2021). The Department of Education was failing Life Skills teachers by not organising workshops that could develop them towards an understanding of different teaching to be employed especially during the post-COVID-19 pandemic. It is important to power up schools after COVID-19, using technology to improve teaching and learning to support teachers on the comparative advantages of technology Margalio (2020). It also emerged that even their schools' managers are not giving them enough time to use one type of tool for a long time to become familiar with it. Thus, teachers were experiencing a problem of not reconnecting their teaching practices effectively.

Nonetheless, Life Skills teachers appreciated working with others because they were sharing ideas on how to redo things and reconnect their teaching practices to recover their work during the post-COVID-19 pandemic. The recovery of Annual Teaching Plans (ATPs) released through Circular S13 of 2021, which aimed at supporting the recovery of learning and ensuring authentic deep learning.

Conclusion

In this paper, we discussed the reconnection of Life Skills teachers' teaching practices during the post-COVID-19 pandemic. We reported inadequate knowledge about the use of different practices, and they were struggling because of the effects of technological challenges. We used CHAT as a theoretical lens to collect and analyse data on how Life Skills reconnect teaching practices to mediate teaching and learning in classrooms. We argued that teachers faced challenges as they lack the knowledge to use different teaching practices and struggled because of the effects of technological challenges. Nevertheless, the Minister of Education proposed a recovery plan to transform Life Skills teachers' teaching practices during the COVID-19 pandemic. Tools used to collect and analyse data revealed rich information as we are now aware of what is happening in Life Skills teachers during this time through the emerging themes.

Thus, this paper recommends that the Department of Education should organise professional development workshops to equip Life Skills teachers with technological skills. There is a need to ensure that proper guidelines are formulated on how teachers should reconnect their teaching practices not only in Life Skills subject to recovery from the disturbances caused by the COVID-19 pandemic. This could assist all teachers to use different teaching practices.

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RETHINKING REDUCTION OF ILLITERACY THROUGH CAPACITY BUILDING OF THE FACILITATORS AND MONITORING OF ADULT BASIC LITERACY PROGRAMME IN NIGERIA

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Abstract

Descriptive survey design was adopted in this study. The population of the study comprised 116 supervisors and 610 facilitators. The sample size for this study was 58 supervisors and 305 facilitators. The instrument used for data collection was a structured questionnaire developed by the researchers. The instrument was face validated by three experts. The researchers administered the questionnaire to 8 supervisors and 16 facilitators of adult education programmes in Delta State to test its reliability. An overall reliability coefficient of 0.84 was obtained which shows that the instrument was reliable. Copies of the questionnaire distributed were completed by the respondents and collected on the spot by the researchers with the help of two research assistants. The questionnaire return rate of 100 percent. Weighted mean and standard deviation were used to answer the research questions, while t-test statistic was used for the analysis of the hypotheses that guided the study. The results indicate that National Mass Education Commission contributes to the reduction of illiteracy through capacity building of facilitators of adult basic literacy programme for national development to a high extent in Enugu State, Nigeria. The findings also indicate that National Mass Education Commission has contributed to the reduction of illiteracy through monitoring of adult basic literacy programme for national development to a high extent in Enugu State, Nigeria. Considering the findings, the researchers recommended among others that adult basic literacy programme development officers organize capacity-building programmes regularly for improving facilitators of adult basic literacy programme for national development.

Keywords: Adult Basic Literacy Programme, Capacity Building of Facilitators, National Mass Education Commission, Monitoring, Reduction of Illiteracy and National Development.

Introduction

Reduction of illiteracy among adults through capacity building of facilitators and monitoring of adult basic literacy programme by the National Mass Education Commission for national development is of paramount importance. This is because the rate of illiteracy in the world particularly in Nigeria is overwhelming. UNESCO (2010) noted that Nigeria is categorized as one of the E-9 countries alongside Brazil, China, India, Egypt, Indonesia, Bangladesh, Pakistan and Mexico with the highest population and highest illiteracy rate. This implies that most people mainly adults in Nigeria are illiterates. Illiteracy is the inability to read, write and calculate in any given language (Alao, 2007). Illiteracy can also be defined as failure of the individuals to read, write, and calculate numbers. Therefore, to address the above issue, there is a need for the reduction of illiteracy among individuals, especially adults.

Reduction of illiteracy can be seen as a means of lessening the number of illiterates by making them literate. Literacy is the ability to read, write and calculate in a given language. (Olagunju, 2007) stated that literacy was introduced by religious organizations in Nigeria by both Islamic and Christian missionaries in the 11th and 16th centuries respectively, primarily

to win converts. However, later, the colonial administrators became interested particularly in adult basic literacy programme to reduce the number of illiterate adults for national development in the year 1946 when Major A. J. Carpenter was chosen as the first Mass Education Officer in Nigeria (Odo, 2015). Hence, the desire to improve national development through adult basic literacy programme in Nigeria.

Adult basic literacy is the major components of adult literacy programmes. NMEC (2012) observed that the components of adult literacy programmes for the actualization of national development include basic literacy, post-literacy, and functional literacy among others. Adult basic literacy programme provides reading, writing and numeracy skills to illiterate adults. Universal Basic Education Commission ([UBEC],2008) noted that the objectives of adult basic literacy are to inculcate in adults permanent literacy, numeracy and ability to communicate effectively among others for national development.

National development is improvement in education, political, economic, environmental and socio-cultural conditions of people in a geographical area. It can be best defined as the total progress of diverse aspects of the country viz. political, economic, social, cultural, education particularly literacy programmes. NMEC (2010) noted that effective and timely provision of adult basic literacy programme to nearly 50 million Nigerians will greatly improve the lives and livelihood of nearly half of the population. The implication is that effective provision of reading, writing and numeracy skills to illiterate adults and out-of-school –youths will bring about national development.

Consequently, in pursuit of the above objective, National Mass Education Commission (NMEC) was officially established on 5th July 1991 and given among other things the duty to eradicate illiteracy among adults for national development within the shortest possible time in Nigeria. Olagunju (2007) noted that in order to effectively pursue its statutory goals and objectives, the Commission apart from its national headquarters in Abuja has zonal offices in each of the six geo-political zones in the country. NMEC also has its units known as State Agency for Mass Education (SAME) located in every state of the federation. The units serve as a link between NMEC headquarters located in Abuja and practitioners of adult literacy, particularly basic literacy programme. There were policies and strategies targeted at getting rid of illiteracy, monitor and standardize execution of mass literacy delivery, network with local and international stakeholders to produce neo-literates that are independent through skills acquisition and functional literacy in Nigeria (Olagunju, 2007). NMEC work diligently to reduce illiteracy through capacity building of personnel, and monitoring of adult literacy programmes among others (Odo, 2015).

Capacity building of the facilitators and monitoring of adult basic literacy programme are very important for the reduction of illiteracy among adults. Capacity is the ability to solve problems and achieve objectives (Maisese, 2005). According to Dane (2010) capacity is method or action that groups take to guarantee that it has the resources needed to succeed). Capacity building, on the other hand, is a set of actions that an association takes to increase its ability to tackle developmental problems or perform fruitfully in its selected area (Ugwu, 2016). Okeke (2009) noted that capacity building involves giving an individual or groups some training to enable them to perform tasks. According to UNESCO, Bandura in his social learning theory explains that people learn within a social context, and that learning is facilitated through concepts such as modelling, observational learning, and imitation. Therefore, capacity building in this study connotes giving the facilitators some training and re-training for effective instructional delivery of adult basic literacy programme. Aloa (2007) noted that the facilitators are the people who guide learners at the learning centres. Facilitators here simply mean those people at adult literacy centres who occupy the position of teachers in formal sector. They are responsible for assisting learners to learn and are monitored by some adult education practitioners including NMEC.

Monitoring is of paramount importance for the success of adult basic literacy programme. Paiko (2006) emphasized that it is always important to monitor adult literacy activities if the desired objectives are to be achieved. Monitoring is a continuous process of regularly and carefully checking, watching and assessing various activities, uses of inputs of projects/programme under execution in order to minimize waste (Paiko, 2010). It involves data collection which is an important process in adult literacy programme. Thus, a monitoring officer in this study is one who engages in regular and careful checking and watching and gathering some data on the activities of the facilitators of adult literacy programmes in their various centres to ensure that the desired objectives of those programmes are achieved. The National Commission for Mass Education (2005) noted that NMEC had developed strategies to coordinate, monitor and promote literacy programmes; working in partnership with the state agencies for mass education which are the implementing agencies nationwide.

Enugu State has three senatorial districts, namely, Enugu North, Enugu East and Enugu West Senatorial Districts which consist of seventeen Local Governments Area. Although, NMEC officials especially those working in Enugu State have been training the adult basic literacy facilitators and monitoring adult basic literacy programme from time to time, yet the percentage of illiterate adults seems not to have been reduced. The implication is that NMEC has been using several strategies to make sure that the number of illiterate adults is reduced with little result. The resultant effects were lack of interest, inadequate funding, poor remuneration of the facilitators, embezzlement of fund meant for the implementation of adult basic literacy programme, inadequate training and monitoring of adult basic literacy programme among others. Therefore, there is a need to determine the extent to which the National Mass Education Commission (NMEC) contributes to the reduction of illiteracy among adults through the capacity building of facilitators and monitoring of adult basic literacy programme for national development. This is because to the best of the researchers' knowledge, the available evidence indicated a dearth of empirical studies in the area of capacity building and monitoring of adult basic literacy programme. Against this background, the study was to assess the extent to which National Mass Education Commission contributes to the reduction of illiteracy among adults through capacity building of the facilitators and monitoring of adult basic literacy programme for national development in Enugu state, Nigeria.

Purpose of the Study

The overall objective of the study was to explore the contributions of NMEC to the reduction of illiteracy through capacity building of facilitators and monitoring of adult basic literacy programme for national development in Enugu State. Explicitly, the study sought to:

1. ascertain the extent to which National Mass Education Commission (NMEC) contributes to the reduction of illiteracy through capacity building of the facilitators for national development in Enugu state, Nigeria.
2. ascertain the extent to which National Mass Education Commission (NMEC) contributes to the reduction of illiteracy through monitoring of adult basic literacy programme for national development in Enugu state, Nigeria.

Research Questions

The following research questions guided the study:

1. To what extent do National Mass Education Commission (NMEC) contribute to the reduction of illiteracy through capacity building of the facilitators for national development in Enugu state, Nigeria?

2. To what extent do National Mass Education Commission (NMEC) contribute to the reduction of illiteracy through monitoring of adult basic literacy programme for national development in Enugu state, Nigeria?

Hypotheses

Two hypotheses guided the study and were tested at 0.05 level of significance.

H₀₁: There is no significant difference in the mean ratings of supervisors and facilitators of adult basic literacy programme on the extent to which National Mass Education Commission contributes to the reduction of illiteracy through capacity building of the facilitators for national development in Enugu state, Nigeria.

H₀₂: There is no significant difference in the mean ratings of supervisors and facilitators of adult basic literacy programme on the extent to which National Mass Education Commission contributes to the reduction of illiteracy through monitoring of adult basic literacy programme for national development in Enugu state, Nigeria.

Research Method

The research adopted a descriptive survey design. Survey research is chosen because the investigators were concerned with the reduction of illiteracy among adults through the capacity building of facilitators and monitoring of adult basic literacy programme by National Mass Education Commission for national development in Enugu State, Nigeria. Enugu State has three senatorial zones which include Enugu North, Enugu East and Enugu West.

The population of the study was 726 which consist of 116 supervisors and 610 facilitators of adult literacy programmes. A proportionate sampling technique was used to sample 50 percent of the entire population. Therefore, the sample size for this study was 58 supervisors and 305 facilitators (363). A structured questionnaire titled Rethinking reduction of illiteracy through capacity building of facilitators and monitoring of adult basic literacy programme for national development in Enugu State, Nigeria (RRICBFMABLPND) was used for the collection of data. The instrument was developed in two clusters which contain 12 items. Four-point numerical values were assigned to the rating scales. The numerical values consisted of Very High Extent (VHE) 3.50 -4.00, High Extent 2.50 -3.49, Low Extent (LE) 1.50 -2.49 and Very Low Extent (VLE) 1.00-1.49.

Three experts face-validated the instrument. Corrections were properly affected, and their objective criticisms and comments guided the final development of the instrument. The researchers distributed the instrument to 8 supervisors and 16 facilitators of adult literacy programmes in Delta State to test its reliability. The state was chosen because it possesses similar characteristics with the area of the study in terms of sociocultural activities. The cronbach-Alpha method was used to determine its reliability coefficient. A grand reliability coefficient of 0.84 was obtained which shows that the instrument was reliable.

The researchers distributed 363 instruments to 58 supervisors and 305 facilitators of adult literacy programmes in the study area. The questionnaires administered were thoroughly completed and returned at a rate of 100 percent. Weighted mean and standard deviation were utilised in answering the research questions while t-test statistic was used for the analysis of the hypotheses formulated to guide the study.

Results

Research Question One: To what extent do National Mass Education Commission contributes to the reduction of illiteracy through capacity building of the facilitators for national development in Enugu state, Nigeria?

Table 1

Mean analysis of the ratings of the respondents

| S/N | Item Statement | \bar{x} | SD | Decision |
|-------------------|---|-------------|-------------|-----------|
| 1 | Giving Technical training to facilitators on data collection for improved data base. | 2.29 | 1.13 | LE |
| 2 | Developing facilitators skills on how to use different techniques for effective instructional delivery | 3.23 | 0.84 | HE |
| 3 | Training and re-training of facilitators on effective methods of instructional delivery of adult basic literacy programme | 2.70 | 1.13 | HE |
| 4 | Organizing capacity building workshops for the facilitators on andragogical skills to enhance their facilitating skills. | 3.40 | 1.04 | HE |
| 5 | Training and re-training of facilitators on the use of effective methods of instructional delivery of adult literacy programmes based on the target groups. | 2.62 | 1.02 | HE |
| 6 | Training of the facilitators on how to motivate the learners to achieve their learning objectives. | 2.42 | 1.11 | LE |
| Grand Mean | | 2.83 | 0.64 | HE |

Table 1 shows that 4 items with mean scores of 3.40, 3.23, 2.70 and 2.62 received positive responses that National Mass Education Commission (NMEC) contributes to reduction of illiteracy through capacity building of the facilitator to a high extent in Enugu state, Nigeria. Items with mean scores of 2.29 and 2.42 portray that National Mass Education Commission (NMEC) contributes to reduction of illiteracy through capacity building of the facilitator for national development to a low extent in Enugu state, Nigeria. The grand mean of 2.83 and standard deviation of 0.64 indicates that National Mass Education Commission contributes to the reduction of illiteracy through capacity building of the facilitator for national development to a high extent in Enugu state, Nigeria.

Table 2

t-test analysis of the mean ratings of supervisors and facilitators

| Respondents | n | \bar{x} | SD | t | df | Sig. (2-tailed) | Decision |
|--------------|-----|-----------|------|------|-----|-----------------|----------|
| Supervisors | 18 | 2.83 | 0.83 | 1.46 | 626 | 0.272 | NS |
| Facilitators | 610 | 2.75 | 0.86 | | | | |

*NS = Not Significant.

Table 2 above shows that the t-calculated value of 1.46 at the significance level of 0.00 was less than the t-critical value of 1.96. Therefore, the null hypothesis was rejected, showing that there was no significant difference between the mean ratings of supervisors and facilitators on the extent to which National Mass Education Commission (NMEC) contributes to the reduction of illiteracy through capacity building of facilitators for national development in Enugu state, Nigeria.

Research Question Two: To what extent do National Mass Education Commission contributes to the reduction of illiteracy through monitoring of adult basic literacy programme for national development in Enugu state, Nigeria?

Table 3

Mean analysis of the responses of the respondents

| S/N | Item Statement | \bar{x} | SD | Decision |
|-------------------|---|-------------|-------------|-----------|
| 1 | Ensuring that the stated objectives of the programmes are achieved. | 2.53 | 1.04 | HE |
| 2 | Motivating the facilitators in providing quality instruction for effective implementation of adult literacy programmes | 2.62 | 1.09 | HE |
| 3 | Ensuring an adequate use of the right curriculum for each learner or target groups | 3.00 | 1.02 | HE |
| 4 | ascertaining whether the teaching-learning materials given to facilitators and learners are of important and adequately utilized for the implementation of the programmes | 3.01 | 1.44 | HE |
| 5 | Creating awareness for adult literacy programmes to individuals in the communities. | 3.15 | 1.37 | HE |
| 6 | Ensuring an increase in learner enrolment in adult literacy programmes | 2.83 | 1.77 | HE |
| Grand Mean | | 2.85 | 0.64 | HE |

Table 3 showed that items 1- 6 with mean scores of 2.53, 2.62, 3.00, 3.01, 3.15 and 2.83 received positive response that National Mass Education Commission (NMEC) contributes to monitoring of adult basic literacy programme for the reduction of illiteracy to a high extent in Enugu state, Nigeria. Grand mean of 2.85 and standard deviation of 0.64 indicates that National Mass Education Commission contributes to monitoring of adult basic literacy programme for the reduction of illiteracy for national development to a high extent in Enugu state, Nigeria.

Table 4

t-test analysis of the mean ratings of supervisors and facilitators.

| Respondents | n | \bar{x} | SD | t | df | Sig. (2-tailed) | Decision |
|--------------|-----|-----------|------|------|-----|-----------------|----------|
| Supervisors | 18 | 2.91 | 1.11 | 1.21 | 626 | 0.23 | NS |
| Facilitators | 610 | 2.82 | 1.14 | | | | |

*NS = Not Significant

Table 4 above shows that the t-calculated value of 1.21 was less than the t-critical value of 1.96 tested at 0.05 level of significance. Therefore, the null hypothesis was rejected, showing that there was no significant difference between the mean ratings of supervisors and facilitators on the extent to which National Mass Education Commission (NMEC) contributes to the reduction of illiteracy through monitoring of adult basic literacy programme for national development in Enugu state, Nigeria.

Discussion of the Findings

The findings indicate that National Mass Education Commission contributes to capacity building of the facilitators of adult basic literacy programme to a high extent in Enugu state, Nigeria. Okechi (2004) noted that for there to be effective literacy delivery the capacity of the facilitators/instructors must be enhanced. Okechi further noted that without equipping the facilitators with better skills the literacy centres are bound to fail as they are the people that interface with the learners in the centres. The implication is that capacity building of the facilitators of adult basic literacy programme is essential for effective delivery of instructions at the learning centres. Aloa (2007) is also in agreement with the finding when he stated that capacity building workshop organized by NMEC for adult literacy facilitators have led to effective literacy delivery in the country. However, several workshops and seminars have

been organized by NMEC for the facilitators of adult basic literacy programme to enhance their performance towards helping the learners to learn for national development. The facilitators are providing training and re-training on information management, how to adopt different techniques for instructional delivery, methods of instructional delivery, andragogical skills, effective methods of instructional delivery and on how to motivate learners to achieve their learning objectives. NMEC (2010) confirmed that the commission has been able to train and retrain several officers and facilitators of adult basic literacy programme. The training and retraining programmes are in the areas of andragogical skills, literacy by radio methodology; Regenerated Frierian Literacy through Empowering Community Technique (REFLECT methodology) and development of monitoring instruments. The major target group for the training are the Facilitators (NMEC, 2010).

In respect to the null hypothesis one, there is no significant difference ($P < 0.05$) in the mean ratings of supervisors and facilitators on the extent to which National Mass Education Commission contributes to capacity building of facilitators of adult basic literacy programme for the reduction of illiteracy in Enugu state, Nigeria.

The finding also indicates that National Mass Education Commission contributes to monitoring of adult basic literacy programme to a high extent for the reduction of illiteracy in Enugu state, Nigeria. Okwor (2007) revealed that effective monitoring of literacy programme enhances literacy programme delivery to a high extent. Consequently, Paiko (2010) stated that the accomplishment of any programme rest on the effective monitoring of the implementation. Wagner (2004) noted that one can provide human and material resources for literacy programme but without effective monitoring he/she can only achieve little or nothing. This shows how important monitoring exercise is to adult literacy programme. Ede (2007) also noted that monitoring and evaluation informs decision-making and enhances policy implementation in adult literacy programme.

In respect to null hypothesis two, there is no significant difference ($P < 0.05$) in the mean ratings of supervisors and facilitators on the extent to which National Mass Education Commission contributes to monitoring of adult basic literacy programme for the reduction of illiteracy in Enugu state, Nigeria. This was revealed in t-cal value of 1.21 which was less than the t-table value of 1.96.

Conclusion

Based on the findings of the study, it was concluded that National Mass Education Commission contributes to the reduction of illiteracy at a high extent in Enugu state, Nigeria. Hence, building the capacities of the facilitators and monitoring of adult basic literacy programme by National Mass Education Commission enables many illiterate adults to enrol and participate in adult basic literacy programme to acquire literacy skills which includes reading, writing and calculation for national development.

Recommendations

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

1. Adult basic literacy programme development officers should be organizing capacity building programmes regularly for improving facilitators of adult education programmes in their instructional delivery. Such capacity building programmes for instance include workshops and seminars through which the facilitators will gain more and innovative skills on facilitation of adult basic literacy programme.
2. Government in collaboration with donor agencies, NMEC and adult education practitioners should be involved in the monitoring of adult basic literacy programme. This is to move from high extent to very high extent to which NMEC reduces illiteracy through

capacity building of facilitators and monitoring of adult basic literacy programme for national development in Enugu state, Nigeria.

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INTEGRATING TECHNOLOGY INTO MATHEMATICS TEACHING AND LEARNING IN EARLY CHILDHOOD DEVELOPMENT

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Abstract

Technology has infiltrated every aspect of our lives, including the home and the classroom, in which students' exposure to media and technology has grown. Young children's engagement with popular culture and communication through technology is an everyday reality. However, the integration of technology into early childhood mathematics classrooms remains a challenge, especially in rural disadvantaged areas. Hence, the study aims to delve into how Early Childhood Development teachers integrate technology into their mathematics teaching in rural centres of OR Tambo Inland District, Eastern Cape Province. Technology Pedagogical and Content Knowledge (TPACK), developed by Koehler and Mishra in 2009, served as the study's theoretical foundation. The areas of teacher expertise that are crucial for utilizing technology in the classroom successfully are the focus of TPACK. A case study design was used in this qualitative investigation. The participants for the study included ten ECD teachers, purposefully selected as information-rich participants in the rural centres of OR Tambo Inland District, Eastern Cape Province. Data was collected using semi-structured interviews and analysed through thematic analysis. The results showed that practitioners were interested in integrating technology into their teaching and learning. However, there were obstacles preventing this from happening, including teachers' lack of confidence in their technical expertise, a lack of technological equipment, physical environment restrictions, and infrastructure. Therefore, the study recommends that the Department of Basic Education should foster Early childhood mathematics teacher education programs that incorporate the use of technology in early mathematics.

Keywords: Technology, mathematics, teaching and learning, integration

Introduction and Background

The term "technology" is often understood as a form of media that is used for creating, displaying, storing, modifying, and transmitting information, according to Rambousek, Procházka, and Wildová (2014). Hence, technology has infiltrated every aspect of our lives including the home and the classroom in which children's exposure to media and technology has grown. The literature indicated that technology could help children develop creativity, learn other languages (via music and video), enhance motor abilities, improve cognitive skills, be a source of diversion for children, provide more enjoyment for kids, educate young ones, and improve competing skills. Therefore, Rideout and Katz (2016) is of the opinion that young children living in today's media are presented with media and technology choices at every turn. Even though technology is crucial to young children's growth and learning, early childhood development (ECD) teachers are typically uninformed and unconfident when employing information and communication technology (Hsin, Li & Tsai, 2014).

Children require some access to a variety of technology and software in order to get familiar with it, according to National Association for the Education of Young Children (2012). However, there hasn't been much improvement in terms of early teachers' use of technology in the ECD curriculum (NAEYC, 2012). This has piqued the researcher's interest

in investigating the perspectives of OR Tambo Inland District rural ECD teachers towards the utilization of technology in their classrooms, with the understanding that the use of technology in education continues to offer children improved possibilities for increasing their cognitive development and engaging in play and academic activities that are necessary for the development of foundational 21st-century abilities (Hsin, Li & Tsai 2014; Miller 2018; Yelland 2011).

According to Miller (2018) & Yelland (2011), the use of technology in education continues to offer better opportunities for enhancing children's cognitive development and encouraging active participation in play and school activities, both of which are necessary for the growth of fundamental 21st-century skills. However, researchers (Atmore 2019; Atmore, Van Niekerk & Ashley-Cooper 2012; Mbarathi, Mthembu, & Diga, 2016) have found that young children in South Africa still encounter numerous difficulties and barriers to receiving a high-quality early childhood education in which technology is infused because of problems like poverty and inequality that seem to have a negative impact on a child's level of educational attainment. According to McPake, Stephen, and Adey (2011), the proliferation of technology-integrated curriculum is developmentally suitable for young children and facilitates the integration of young children's digital experiences at home and in school. Due to inequality, poverty, cultural restrictions, and economic constraints, it is asserted that many children do not have access to or exposure to digital technologies (Edwards, 2016).

Technologies that have quickly assimilated into society and can meet the needs of the new generations of learners are driving the change in how we learn (Taber, 2017). The world's economy depends heavily on developing technically trained workers, thus educators, politicians, and employers must pay close attention to this issue (Brown & Green, 2018). Education institutions are asked to provide the best quality education, notably technology proficiency, to a hugely diversified audience at a cost that the government can afford now that society has adopted a global emphasis aided by technology (Orta, 2019). To ensure that graduates have the abilities necessary for a global, technological, information society, and teachers should understand the significance of integrating technology into the delivery of instruction (Vidal, 2020).

According to Mertala (2019), several ECD teachers are concerned that the increasing use of technology in their homes would lead to children spending an unreasonable amount of time using technology in their centers. Moreover, many educators think it's crucial for kids to develop digital skills now, even though they might not assist their academic careers in the long run (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). The literature has elaborated more on how technology infusion can improve the child's cognitive development. However, little is said about the impact of technology implementation in rural ECD centres in OR Tambo District Inland. Furthermore, there is no mention in the literature of teachers' opinions on the use of technology in rural ECD classrooms, despite the fact that teachers are the curriculum's implementers and teachers' pedagogical opinions are the final boundary in the pursuit of technology integration.

In addition to the successful integration of ICT across a range of course subjects, Kim, Lee, Spector, and DeMeester (2013) mention that a number of factors prevent ICT from being used effectively for teaching and learning. These include teachers who lack the necessary training to adopt and use ICT technologies, a lack of internet access, technological facilities and equipment, and poor physical infrastructure conditions. Due to their ingrained convictions, many ECD teachers also find it difficult to adjust to contemporary and technologically innovative pedagogical approaches. According to Kim, Lee, Spector, and DeMeester (2013), this has resulted in children's lack of foundation phase preparation for formal schooling. Furthermore, according to Human, Van der Walt, and Posthuma (2015), the foundation phase performance and competency levels of students in science,

mathematics, and language bring the true nature of this lack of preparation into stark perspective.

Nevertheless, while much has been written in the literature about the various factors that hinder the use of technology in the classroom, little has been written on the challenges rural ECD teachers face in implementing technology. This has intrigued the researcher's curiosity in discovering more about the views and challenges that rural ECD teachers face when it comes to integrating technology into their classroom teaching.

Objectives

The objectives of the study were to investigate how ECD teachers in rural ECD mathematics classrooms integrate technology into their teaching explore computer knowledge and skills ECD teachers possess, and explore factors that hinder ECD teachers in their use of technology when teaching in rural ECD classrooms

Research Questions

- How do ECD teachers in rural ECD mathematics classrooms integrate technology into their teaching?
- What computer knowledge and skills do ECD mathematics teachers possess?
- What hinders ECD mathematics teachers in their use of technology when teaching in rural ECD classrooms?

Theoretical Framework

The study is supported by Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK) (2006). This especially refers to the knowledge needed to integrate the use of technology in subject-matter instruction. The knowledge that centers on the triple nexus of technology, pedagogy, and content is referred to as TPACK by Kildan and Incikabi (2015). Teachers must be able to comprehend how technology can be used pedagogically in ways that are relevant to the subject(s) being taught, which is why TPACK is used in the study (Koehler, Mishra, Kereluik, et al., 2014). Therefore, there is a recognized need to improve early years teachers' TPACK and broaden it to incorporate their comprehension of the significance of certain technological tools for young children (Voogt and McKenney, 2017). Mertala (2016) reveals that for teachers to effectively implement technology in their classes, they need to be well-informed about digital media cultures that are vital for children. This does not imply, however, that teachers must be fully aware of everything that students use and engage in in the digital sphere. As opposed to this, having some experience with the environment is helpful so that teachers can let children be the experts regarding their own digital behaviors and inform teachers about these (Parry, 2013).

Methodology

Research approach

A qualitative research method was employed in this study. The researcher was assisted by a qualitative research approach in determining the significance of a phenomena (technology) from the perspectives of participants (Creswell, 2018).

Study site

Five conveniently chosen rural ECD centers in the OR Tambo Inland District served as the research's study locations. Creswell (2018) advocates choosing websites that are full of information. The five ECD facilities that were chosen were thought to be information-rich locations.

Participants' selection

Purposive sampling was used to select two teachers from each of the five centres, making a total of ten participants for the study. The purposive sampling allowed the researcher to make a "judgment" and select criteria to identify the most suitable participants (Pietersen & Maree, 2016). The teachers were selected as information-rich participants related to the phenomenon of interest (integration of technology into mathematics teaching and learning), making a total of ten teachers (purposive sampling).

Instruments for data collection

The study used semi-structured interviews to understand the views of the ECD teachers on the use of technology in young children to develop technology skills in young children within actual-life contexts (Nieuwenhuis, 2016).

Data collection procedures

The researcher respected the autonomy of the relevant ECD centers, the authority of the departments, including the Department of Social Development, and the authority of the center managers of the corresponding ECD centers when collecting data. An interview guide with questions pertaining to the study's main finding, the use of technology in mathematics instruction and learning, was also provided (Creswell 2018). Data was gathered during the interviews using a recorded tape, and participants were prodded for additional information. To ensure that the research process is ethical, the researcher saw to it that a number of ethical protocols were in place. Participants' rights, informed permission, professionalism, secrecy, protection from harm, obtaining anonymity, and participants' vulnerability were all covered by the protocols.

Data analysis procedures

Thematic analysis was utilized in the study to find patterns or themes in qualitative data (Braun & Clarke, 2006). According to Creswell (2018), thematic analysis is the process by which data are divided into segments, followed by codes, categories, and themes. According to Creswell (2018), the data were analyzed using thematic analysis in the following three processes, which are as follows:

1. Organizing the data and defining the code is the first step.
2. Creating the categories and codes is step two.
3. The third step is creating themes and sub-themes.

Discussion Of Findings

Theme 1: ECD teacher's integration of technology in the classroom

The findings of the study revealed that ECD teachers were of the opinion that computers were very necessary, especially in this technologically advanced world. This is revealed by their answers when asked about how they use technology in their classrooms:

P1: "Computers are very necessary for children, especially in this technologically advanced world. It is important for teachers to teach using computers that have computer programmes and software for young children."

P2: "Computer use is very important to children as it provides them with quality verbal interactions with both the teachers and other children. Young children can learn reading skills through images and videos"

P3: "Young children can strengthen their math skills by learning data computing through technology and also improve their social skills by learning how to communicate in a concise fashion"

Theme 2: Computer knowledge and skills ECD teachers possess

The findings of the study revealed that some teachers were computer literate but lacked information on computer programmes for young children. Therefore, they lacked the requisite knowledge and skills in computer education for young children.

P1: "What I can only do with a computer is typing and I wonder whether this could benefit young children"

P2: "I really doubt my ability to use computers especially for teaching young children and after all they do not matter since these skills are not examined, even at grade seven levels."

Additionally, ECD teachers at some centers stated that the lack of a computer laboratory was the main issue because their center rented space in an area that was also used by residents.

These are their responses:

P1: "We cannot install computers in that location because it is unsafe because our center rents two classrooms in a shared space. Even if we can be sponsored by computers, there will be no space for them because our classes are full and we are unable to form a sitting arrangement that is suitable for young children"

P3: "Our centre is not safe so even if we can get those computers they will be stolen"

P4: "We don't have an infrastructure that is safe and secure for installation of computers even our laptops are not easy to carry them from home to school every day"

Theme 3: Factors hindering ECD teachers in their use of technology

P1: "The major problem that prevents the use of technology in rural early childhood centres is that most of us teachers don't know how to use the technology for effective and developmentally appropriate teaching. So, what most ECD centres do is that they invite an expert who comes to their school to do these computer classes for the children"

P2: "The problem is, I do not have enough training on how to use or assess appropriate technology for children of their age, plus we have problems with lack of resources in this centre"

The study's findings showed that although some teachers had limited experience with computers, they needed tools and support which was also lacking. This is shown by their responses:

P4: "We do not have enough technological resources in this school, and there are no supports that I know of except that I involve myself in many readings related to the use of technology in teaching".

Discussion Of Findings

In the theme of ECD teachers' integration of technology, the findings revealed that teachers in rural ECD centres understood the importance of using technology in their content and instructional practices. Furthermore, many educators think it's crucial for children to develop digital skills now even though they may not assist their academic future in the long run (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). They also recognized that utilizing technology in the classroom continues to offer better options for enhancing kids'

cognitive growth and encouraging active engagement in play and academic activities, both of which are necessary for the development of core 21st-century abilities (Miller, 2018, Yelland 2011). According to McPake, Stephen, and Adey (2011), the extension of a mathematics curriculum that incorporates technology is developmentally appropriate for young children and bridges their digital experiences at home and at school.

The findings of the study on the theme of teachers' computer knowledge and skills revealed that some of them had minimal computer knowledge. Therefore, they were forced to use traditional teaching methods since they lacked the ability to teach students effectively while using technology. To ensure that students have the skills necessary for a global, technical, information society, teachers must understand the value of integrating technology into the delivery of instruction (Vidal, 2022). Additionally, due to inequality, poverty, cultural barriers, and lack of technical proficiency among teachers, children were not exposed to digital technologies (Edwards, 2016).

The study discovered that the major problems are the lack of computer skills, lack of resources, and infrastructure. However, according to Brown & Green (2018), children who used interactive technology in the form of math applications as a component of a play-based learning environment for mathematics showed only modest increases in achievement as determined by a pre- and post-test. Therefore, educators, governments, and employers should pay close attention to the issues of global concern.

Conclusion

The findings of the study revealed that ECD teachers were interested in integrating technology in the teaching of mathematics. However, technical issues are still difficult to solve. Therefore, ECD teachers must be equipped with the skills necessary for using technology in order for integration to successfully occur in the teaching of mathematics. Based on the outcomes of the study the following recommendations are suggested: Use of interactive technology in the form of mathematics applications as part of a play-based learning environment for mathematics; capacitation of ECD teachers on technical skills; integration of technology in the professional development of ECD teachers and improvement of safe and secure ECD infrastructures. Thus, these findings have implications for both the infrastructure that is appropriate for the installation of computers and the training of teachers on how to integrate technology in their teaching of mathematics.

Limitations

The main focus of the study is on ECD teachers, and the results only apply to the sample of four teachers from two early-childhood centres. Therefore, generalizations to the full population are challenging to establish because the study only included participants from four OR Tambo Inland District participants selected from the two ECD centres. Therefore, future studies should combine different techniques to provide data at the population level.

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PLANNING AND EVALUATION FUNCTIONS IN THE MANAGEMENT OF ADULT EDUCATION PROGRAMMES FOR ENHANCING TEACHING STRATEGIES IN LEARNING CENTRES IN SOUTH EAST STATES OF NIGERIA

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Abstract

Management of adult education could be regarded as an effective and systematic way of planning, organizing, coordinating, directing, supervising, and evaluating educational programme of activities for adult learners for the optimum attainment of educational and organizational goals. This study looked at the planning and evaluation roles in the management of adult education programs with the goal of enhancing teaching techniques in learning centers in the South-East States of Nigeria. There were two research questions and two hypotheses proposed. The investigation employed a descriptive survey research design. Four thousand and three (4003) respondents made up the study's population, which included 3973 facilitators, 5 directors, and 25 members of the center-based management committee (CBMC). A multi-stage sampling method was used to select a sample of 427 participants for the study. The instrument for data collection was a 55-item structured questionnaire tagged "Management Functions of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres Questionnaire (MFAEPETSLCQ)", modeled on a four-point rating scale. A grand reliability co-efficient of 0.94 was obtained. Utilizing both descriptive and inferential statistics, the data collected was examined. The findings revealed among others that planning functions include involving stakeholders in programme planning in adult education. While the evaluation functions among others include: measuring the facilitators and coordinators input in learning centres. Moreover, enhancing teaching strategies depends on proper application of the above identified management functions. The study recommended among others that formative and summative evaluation should be employed in order to make adult education programmes more effective.

Keywords: Planning, evaluation, management, adult education programmes, teaching strategies

Introduction

In Nigeria, a deliberate and practical step toward managing adult education effectively began with the establishment and inauguration of the National Commission for Mass Literacy, Adult, and Non-Formal Education (NMEC) in 1990 and 1991, respectively, under Decree No 17 (Federal Republic of Nigeria, 2014). According to the order, the commission must:

- (i) co-ordinate Mass Literacy, Adult and Non-formal Education programmes nation-wide.
- (ii) ensure uniform standards and quality control nation-wide.
- (iii) liaise with national, non-governmental organisations and corporate bodies for implementation of mass literacy.
- (iv) prepare the necessary personnel for the state agencies.

- (v) develop curricula and didactic materials for mass literacy, adult and non-formal education; and
- (vi) provide a nationally recognized basic education certificate (FRN, 2014, p. 20)

The state agencies, among other things, are to complement the efforts of the Federal Government and NGOs in management practices within the states. Such practices include planning, organization, development, management, training of personnel, and provision of necessary instructional materials for adult education programmes in the states (FRN, 2014). Similarly, local government councils are to be responsible for the day-to-day control and management of adult education programmes through the recruitment of part-time instructors, the provision of physical facilities for adult education programmes and the provision of feedback to the state and Federal Government with respect to curriculum and instructional materials.

In addition, the Federal Ministry of Education (FME) and NMEC also ensure quality assurance of programmes and collaborate with international development partners and Non-Governmental Organizations (NGOs)/ Civil Society Organizations (CSOs) in programme planning and implementation (Anibueze, 2016). Supporting the above view, NMEC monitors the activities of the State Agency for Mass Literacy, Adult and Non-Formal Education (SAME) in each state of the federation through its six zonal offices. The zones are South-East, South-West, South-South, North-East, North-West, and North-Central (NMEC, 2013). Meanwhile, for effective teaching and learning in centres in South-East Nigeria, NMEC has developed a lot of teaching strategies to facilitate learning. These teaching strategies include literacy by radio, REFLECT (Regenerated, Freirean Literacy through Empowering Community Techniques), traditional classroom/primer-based instruction, demonstration, among others. Most of all these teaching strategies are currently in practice (Victoria-King, 2011). Teaching strategies as a concept can be referred to as approaches or techniques of teaching employed by facilitators or teachers to facilitate learning and for effective learning outcomes. A teaching strategy, for instance, takes the form of arranging learners into small tutorial groups for a quiz; this strategy is a specific means by which general teaching objectives are accomplished (Ihejirika, 2013).

To enhance teaching strategies, there is a need for effective management of adult education programmes. Adult education was perceived by Onyenemezu (2012) as the education (formal, informal and non-formal) made available to any adult person to socially, economically and culturally improve and empower him or her so that the person will be able to contribute meaningfully as a useful and acceptable member of society

Adult education programmes are all forms of educational activities designed for adults and youths to better their lives. Aderinoye (2002) identified some programmes of adult education in Nigeria aimed at addressing the high illiteracy level and social deprivation of the marginalized as: Basic Literacy, Post Literacy, Women's Education, Functional Literacy, Nomadic Education, Continuing Education, 'Quran' Integrated Education, among others. However, management of adult education programmes is a complex process as the heterogeneous nature of adult needs has brought about diversities in adult education programmes with diverse management approaches to address and capture the individual and distinctive needs of adult learners (UNESCO, 2011). Management as a concept, as perceived by Obidiegwu (2014), is the combination of human and material resources efficiently and effectively in order to accomplish the goals of adult education programmes in all facets of life and in all contexts (family, community, religion, politics, education, and economics, among others).

In the past, the government of Nigeria asked the populace to form a group known as the Centre Based Management Committee (CBMC) in order to manage adult education programs effectively. The CBMC was inaugurated by NMEC in 2015 in all the State Agencies for Mass Literacy, Adult and Non-Formal Education in Nigeria (SAME) has a representative each in CBMC. Additionally, in order to manage adult education programs effectively in Nigeria and the South-East States in particular, the following management tasks must be properly performed: They are as follows: planning, organising, staffing, directing, supervision, and evaluation, among others (Oluborode, 2007). For the purpose of this study, the following management functions are considered for enhancing teaching strategies. These functions include planning and evaluation.

Planning: This is a basic and continuing process in the life of any organization. It is the pivot around which other functions of management revolve. It involves many tasks and activities, which include determination of processes and actions that involve setting goals, developing approaches, outlining the implementation activities and allocating resources towards the accomplishment of predetermined goals (Obidiegwu, 2014). In the planning of adult education programmes, it involves decision-making by the stake holders about the strategies to implement in order to achieve the intended objectives; allocation of resources; and scheduling to ensure timely completion of each programme. Nkang (2002) stated that planning leads to a desired result, helps in the wise allocation of limited resources, and enhances the realization of organizational goals. Meanwhile, people that are supposed to be involved during the planning stage are not considered in programme planning. Even the beneficiaries are supposed to be part of the planning team, but they are not. These affect the programmes in so many ways. Programme planners are meant to create a conducive physical and psychological atmosphere for teaching and learning. The scheduled time must be suitable for participants' personal and work lives and should not coincide with both local and national events in order to enhance participation (Obidiegwu, 2014).

Evaluation: This is about measuring the impact of the contribution made by the programme, services, or product. Adult education organizations have to make provision in their plans for the continuous monitoring and evaluation of their courses, programmes and service delivery (Nafukho, Wawire & Lam 2010). However, evaluation can be directed into two main areas, namely, adult education programmes and workers' performance. Managers can assess facilitators using evaluative methods like observation, visiting a classroom, or conducting interviews (Mgbodile, 2004). Evaluation of adult education programme is concerned with the process and product relationship in adult education, i.e., the question of how effectively the process of adult education is achieving the desired product or result (Egenti, 2012). Hence, this will help the managers to make amendments where there are loopholes in order to enhance teaching strategies. Evaluation is usually done at the end of programmes. The graduates of post-literacy programmes, which are the equivalent of primary schools, join their counterparts and write the First School Leaving Certificate Exam at the end of the programme (Anibueze, 2016).

Considering the above management functions, it is obvious that teaching strategies in adult education learning centres cannot be enhanced if there is no proper management of adult education programmes in the South East States of Nigeria.

Adult education learning centres are expected to aid adult learning, among other things. Education program objectives have not yet been achieved due to a lack of proper planning and evaluation of human and material resources by adult education managers (Aruma 2012). Further, the author noted that the three tiers of government in Nigeria have failed to ensure a good plan of action for providing strong political will and financial resources as well as active participation of all the relevant stakeholders, such as adult educators and adult learners, along with others, that are required to deliver on the promise of

providing basic education to all for effective results in Nigeria. The study sought to determine the planning and evaluation functions in the management of adult education programmes in enhancing teaching strategies in learning centres in South East States Nigeria.

Statement of the Problem

Numerous teaching strategies have been created and supported by NMEC in learning centers in Nigeria, but adult learners are negatively impacted by these teaching strategies. It is quite remarkable that the majority of students' poor academic performance is fundamentally related to the facilitators' use of ineffective teaching methods. Poor planning that results in inadequate instructional facilities, inadequate funding, and subpar programme evaluation are some of the factors preventing facilitators in adult education learning centers from using effective teaching strategies. Due to all of the aforementioned factors, students perform poorly and soon dropout of programmes.

It is becoming increasingly clear that managers of adult education programmes must use management processes like planning, organizing, and evaluation among others in order to have a huge impact on the organization. So, focus of this study is to understand the management of adult education programmes needs planning and evaluation functions to improve teaching methods in learning centers in South-East States of Nigeria.

Review of Related Empirical Studies

In a related study, Obodo (2006) studied planning as a necessary tool for promoting adult and non-formal adult education in Benin. The design of the study was survey research. The population was 88 stakeholders. The entire population was used; hence, there was no sampling. The instrument for data collection was a questionnaire. The collected data were analyzed using weighted mean for the research questions. The finding of the study was that planning is an indispensable aspect for promoting adult and non-formal education. It was recommended that government and stakeholders should restructure the planning of adult and non formal education programme in Benin. This study and the present study are related as both of them used planning as an indispensable strategy for meaningful development in adult education. Igwe (2006) assessed the evaluation strategies of administrators and learners of adult education programmes in Ebonyi State. The researcher adopted descriptive survey research design. The population of the study was 1,142 stakeholders. The sample for the study was 380 stakeholders drawn using stratified proportionate sampling techniques according to the constituencies in the state. Data were analyzed using descriptive statistics such as mean and standard deviation for research questions and ANOVA for testing hypotheses. The findings revealed among other things that the instructors did not attend classes regularly and the learners were not interested in attending classes. It was recommended that both formative and summative evaluation be employed to make the programme effective. This study and the present study used evaluation strategy on instructors to assess their performances.

Purpose of the Study

The general purpose of the study was to examine the planning and evaluation functions in the management of adult education programmes for enhancing teaching strategies in the learning centres in South-East, Nigeria. Specifically, the study sought to:

1. determine the planning functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South-East, Nigeria;
2. ascertain the evaluation functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South-East Nigeria.

Research Questions

The following research questions guided the study:

1. What are the planning functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South-East States, Nigeria?
2. What are the evaluation functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South-East States, Nigeria?

Hypotheses

The following hypotheses guided the study. They were tested at 0.05 level of significance

H₀₁: There are no significant differences among the mean ratings of State agency directors, CBMC members and facilitators on the planning functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South- East States, Nigeria.

H₀₂: There are no significant differences among the mean ratings of State agency directors, CBMC members and facilitators on the evaluation functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South- East States, Nigeria.

Methodology

The study was conducted using descriptive survey research design, which aimed at collecting data on and describing in a systematic manner, the characteristics, features or facts about a given population (Nworgu, 2015). Therefore, descriptive survey design is considered appropriate for the study. The population of this study was made up of 4003 respondents which was comprised of 5 directors, 25 Centre Based Management Committee Members (CBMC) and 3973 facilitators. This consisted of one director from each state, totaling 5 directors and 25 CBMC members 5 from each state, 565 facilitators in Abia State, 805 facilitators in Anambra State, 193 facilitators in Enugu State, 1262 facilitators in Imo State, 1148 facilitators in Ebonyi State (NMEC, 2016). Meanwhile, the area was chosen because of the fact that it is well known for their efforts and interest in acquiring adult education.

The Sample for this study was 427 subjects consisting of 397 facilitators, 5 directors and 25 CBMC members. Multi-stage sampling technique was used to compose the sample. Stage one: all the facilitators were selected, stage two 10 percent was purposively sampled and used for the study. Stage three all the 5 directors and 25 CBMC participated in the study within the 5 states. The sample of the facilitators were drawn in line with the finding of Nwagu, (2005) who stated that the sample size for specific population could be at least 40% for a population of few hundreds, 20% for many hundreds, 10% for few thousands and at most 5% for several thousands. Therefore, in this study, 10% was used for the sample of 397 participants were drawn from a population of a few thousand facilitators. The researchers adopted proportionate stratified random sampling technique. In stage four the proportionate stratified sampling technique was used to select facilitators to a relative proportion or strata according to available states population for proper representation in each state.

The questionnaire that was used for data collection is titled, Management Functions of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres Questionnaire (MFAEPETSLCQ), which consisted of 55 items. The questionnaire was made up of two (2) sections A and B. Section A was to elicit information from respondents about their status, while section B was to elicit information from respondents on Management Functions of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres. The instrument for data collection was subjected to face validation by three (3) experts in the Faculty of Education, University of Nigeria Nsukka. One of the experts was

from measurement and evaluation unit of Science Education Department and the other two experts were from the Department of Adult Education and Extra-Mural Studies. Reliability of the instrument was ascertained using Cronbach Alpha. A grand reliability coefficient of 0.94 was showing that the result was high and the instrument is reliable. The researcher administered 427 copies of questionnaire to respondents at their various locations. The researchers achieved this with the help of four research assistants. The research assistants were instructed and guided by the researchers on how to administer the instrument to ensure safe handling and return of the instrument within one week. Out of 427 copies of the questionnaire distributed, 411 copies were duly filled and returned. This gave a percentage return rate of 96%. However, 16 copies were wrongly filled and so were discarded. The data collected for this study were analyzed using descriptive and inferential statistics. Mean and standard deviation was used to answer the research questions. For the research questions, a real limit of 3.50-4.00 for strongly agree, 2.50-3.39 for agree, 1.50-2.49 for disagree and 0.50-1.49 for strongly disagree was used as criteria decision rule. The null hypotheses were tested using Analysis of Variance (ANOVA) at the 0.05 level of significance. Any item with the probability value less than the 0.05 level of significance was rejected while any item with probability value greater than the 0.05 level of significance was accepted.

Results

Research Question 1: What are the Planning Functions in the Management of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres in South-East, Nigeria?

Results to Research Question one are presented on Table 1

Table 1: Mean and Standard Deviation of Respondents on the Planning functions in the Management of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres in South-East, Nigeria? N=411

| S/N | ITEM STATEMENT | \bar{X} | SD | DECISION |
|-------------------|--|-------------|-------------|----------|
| 1 | Involving stake holders in programme planning in adult education. | 3.78 | .432 | SA |
| 2 | Considering norms of the community where learning centres are situated. | 2.67 | .536 | A |
| 3 | Involving centre management committee in decision making process. | 3.70 | .431 | SA |
| 4 | Acquisition of relevant ICT facilities for teaching and learning like computer, television, radio and handsets among others. | 2.59 | .497 | A |
| 5 | Using accurate time for self-reflective inventories to plan personal teaching goals for facilitators | 2.72 | .520 | A |
| 6 | Arranging for support for facilitators in terms of cash and gift at the end of the session. | 2.76 | .480 | A |
| 7 | Review of progress in reaching goals for facilitators and learners. | 2.71 | .520 | A |
| 8 | Arranging for conducive learning centres including input for facilitators and output to learners | 2.79 | .424 | A |
| 9 | Arranging for collaboration between NMEC and international development partners like UNESCO, World Bank, UNDP among others. | 2.79 | .481 | A |
| Grand Mean | | 2.83 | .040 | A |

Note: \bar{X} =Mean, SD=Standard Deviation, N= Number of Respondents=411, SA= Strongly Agree and A=Agree

The results present on Table 1 show the mean and standard deviation of respondents on the planning functions in the management of adult education programmes for enhancing teaching strategies in learning centres. The results showed that all the respondents agreed that all the item statements on planning practices were accepted as appropriate with item number 1 and 3 indicating strongly agree and others agree. These functions range from items 1-9 as

shown on the table. This is because; the mean responses of the respondents in all the items indicating agree ranges from 2.50-3.39 while the items indicating strongly agree ranges from 3.50-4.00. This decision was reached because the mean values of all the items are within the range of strongly agree and agree decision criteria. Therefore, with a grand mean of 2.83, it implies that all the respondents agreed on all the planning functions. The standard deviation of the items with their values ranging from 0.424 – 0.536 implies that the responses of the respondents showed less variation due to the closeness of the values, and this makes the findings appropriate and reliable for application.

H₀₁: There are no significant differences among the mean ratings of adult education directors, CBMC members and facilitators on the planning functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South-East, Nigeria.

The Results of Hypothesis 1 are presented on Table 2

Table 2: One Way ANOVA Analysis of Respondents on the Planning Functions in the Management of Adult Education Programmes for Enhancing Teaching Strategies for Enhancing Teaching Strategies in Learning Centres.

| S/N | ITEM STATEMENT | Partition | Sum of Squares | Df | Mean of Square | F-ratio | P-value | DECISION |
|-----|--|----------------|----------------|-----|----------------|---------|---------|----------|
| 1 | Involving stake holders in programme planning in adult education. | Between Groups | .863 | 2 | .431 | 2.3 | .100 | NS |
| | | Within Groups | 75.970 | 408 | .186 | 16 | | |
| | | Total | 76.832 | 410 | | | | |
| 2 | Considering norms of the community where learning centres are situated. | Between Groups | .819 | 2 | .409 | 1.4 | .242 | NS |
| | | Within Groups | 117.371 | 408 | .288 | 23 | | |
| | | Total | 118.190 | 410 | | | | |
| 3 | Involving centre management committee in decision making process. | Between Groups | .006 | 2 | .003 | .01 | .985 | NS |
| | | Within Groups | 76.233 | 408 | .187 | 6 | | |
| | | Total | 76.238 | 410 | | | | |
| 4 | Acquisition of relevant ICT facilities for teaching and learning like computer, television, radio & handsets among others. | Between Groups | .525 | 2 | .263 | 1.0 | .347 | NS |
| | | Within Groups | 101.080 | 408 | .248 | 61 | | |
| | | Total | 101.606 | 410 | | | | |
| 5 | Using accurate time for self-reflective inventories to plan personal teaching goals for facilitators | Between Groups | .239 | 2 | .119 | .44 | .644 | NS |
| | | Within Groups | 110.783 | 408 | .272 | 0 | | |
| | | Total | 111.022 | 410 | | | | |
| 6 | Arranging for support for facilitators in terms of cash and gift at the end of the session. | Between Groups | .297 | 2 | .148 | .64 | .527 | NS |
| | | Within Groups | 94.336 | 408 | .231 | 2 | | |
| | | Total | 94.633 | 410 | | | | |
| 7 | Review of progress in reaching goals for facilitators and learners. | Between Groups | .349 | 2 | .174 | .64 | .527 | NS |
| | | Within Groups | 110.912 | 408 | .272 | 1 | | |
| | | Total | 111.260 | 410 | | | | |
| 8 | Arranging for conducive learning | Between | .220 | 2 | .110 | .60 | .544 | |

| | | | | | | | | |
|---|---|----------------|--------|------|-------|-----|------|----|
| | centres including input for facilitators and output to learners | Groups | | | | 9 | | NS |
| | | Within Groups | 73.784 | 408 | .181 | | | |
| | | Total | 74.005 | 410 | | | | |
| 9 | Arranging for collaboration between NMEC and international development partners like UNESCO, World Bank, UNDP among others. | Between Groups | .277 | 2 | .138 | .59 | .552 | NS |
| | | Within Groups | 94.881 | 408 | .233 | 5 | | |
| | | Total | 95.158 | 410 | | | | |
| | | | | | Grand | | | F |
| | | | .868 | .507 | NS | | | |

Note: df= Degree of Freedom, NS=Not Significant.

The results shown on table 2 revealed that all the respondents indicate no significant differences in their mean ratings on the planning functions in the management of adult education programmes for enhancing teaching strategies in learning centres in all the items. This was also reflected in the grand F of 0.507 This was as a result of the probability values (P_{val}) of all the items being greater than the 0.05 level of significance ($P > 0.05$).

Research Question 2: What are the Evaluation Functions in the Management of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres in South-East, Nigeria?

Results to Research Question two are presented on Table 3

Table 3: Mean and Standard Deviation of Respondents on the evaluation functions in the management of adult education programmes for Enhancing Teaching Strategies in Learning Centres.

| S/N | ITEM STATEMENT | \bar{X} | SD | DECISION |
|-------------------|--|-------------|-------------|----------|
| 10 | Measure the facilitators and coordinators input in learning centres. | 3.67 | .554 | SA |
| 11 | Checking goal achievements at the end of the programme. | 2.83 | .425 | A |
| 12 | Adequate evaluation mechanism of facilitators by the supervisors. | 2.88 | .420 | A |
| 13 | Monitoring of the facilitators and coordinators regularly. | 2.73 | .487 | A |
| 14 | Achievement of learners at the end of their programmes in their various centres should be ascertained. | 2.85 | .381 | A |
| Grand Mean | | 2.99 | .067 | A |

Note: \bar{X} =Mean, SD=Standard Deviation, N= Number of Respondents=411, SA= Strongly Agree and A= Agree

The results on table 3 revealed the mean and standard deviation of respondents on the evaluation functions in the management of adult education programmes for enhancing teaching strategies in learning centres. These functions ranged from items 10-14 as shown on the table. The results revealed that the respondents indicated, strongly agree, on item number 10, and agree, on items numbers 11-14. This was because, the mean responses of the respondents in the item that indicated strongly agree fell within the range of 3.50-4.00 which was the criterion for strongly agree and 2.50-3.39 which was the criterion for agree. Meanwhile the grand mean of 2.99 falls within the criterion range of agree. Therefore, it

implies that all the respondents agreed on all the evaluation practices. The standard deviation of the items with their values ranging from 0.381 – 0.554 implies that the findings were appropriate and reliable for application.

H₀₂: There are no significant differences among the mean ratings of state agency directors, CBMC members and facilitators on the evaluation functions in the management of adult education programmes for Enhancing Teaching Strategies in Learning Centres in South East Nigeria

The Results of Hypothesis 2 are presented on Table 4

Table 4: One Way ANOVA Analysis of Respondents on the evaluation functions in the management of adult education programmes for Enhancing Teaching Strategies in Learning Centres.

| S/N | ITEM STATEMENT | Partition | Sum of Squares | Df | Mean of Square | F-ratio | P-value | DECISION |
|----------------|---|----------------|----------------|-----|----------------|---------|-------------|-------------|
| 10 | Measure the facilitators and coordinators input in learning centres. | Between Groups | .178 | 2 | .089 | .289 | .749 | NS |
| | | Within Groups | 125.783 | 408 | .308 | | | |
| | | Total | 125.961 | 410 | | | | |
| 11 | Checking goal achievements at the end of the programme. | Between Groups | .136 | 2 | .068 | .376 | .687 | NS |
| | | Within Groups | 73.941 | 408 | .181 | | | |
| | | Total | 74.078 | 410 | | | | |
| 12 | Adequate evaluation mechanism of facilitators by the supervisors | Between Groups | .306 | 2 | .153 | .866 | .421 | NS |
| | | Within Groups | 72.122 | 408 | .177 | | | |
| | | Total | 72.428 | 410 | | | | |
| 13 | Monitoring of the facilitators and coordinators regularly. | Between Groups | .061 | 2 | .030 | .127 | .881 | NS |
| | | Within Groups | 97.560 | 408 | .239 | | | |
| | | Total | 97.620 | 410 | | | | |
| 14 | Achievement of learners at the end of their programmes in their various centres should be ascertained | Between Groups | .177 | 2 | .088 | .605 | .546 | NS |
| | | Within Groups | 59.638 | 408 | .146 | | | |
| | | Total | 59.815 | 410 | | | | |
| Grand F | | | | | | | .450 | .661 |

NS

Note: *df*= Degree of Freedom, NS= Not Significant.

The results presented on table 4 revealed that there are no significant differences in the mean ratings on the evaluation functions in the management of adult education programmes for enhancing teaching strategies in learning centre. This was also reflected in the grand F of 0.661. These items that indicated no significant difference have their probability values (P_{val}) greater than the 0.05 level of significance ($P > 0.05$).

Discussion of the findings

Planning Functions in the Management of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres.

The result on Table 1 showed that all the respondents agreed that all the item statements are planning functions in the management of adult education programmes for enhancing teaching strategies in learning centres. Such item statements include; involving stakeholders in programme planning in adult education; involving centre management committee in decision making process; arranging for conducive learning centres including input for facilitators and output to learners; arranging for collaboration between NMEC and international development partners like UNESCO, World Bank, UNDP among others; arranging for support for facilitators in terms of cash and gift at the end of the session; using accurate time for self-reflective inventories to plan personal teaching goals for facilitators; review of progress in reaching goals for facilitators and learners among others. Moreover the responses of the respondents on planning practices were accepted for application because there was no significant difference among the mean ratings of the respondents. The finding is in line with the study of Nkang (2002) who stated that planning leads to a desired result, helps in the wise allocation of limited resources, and enhances the realization of organizational goals.

Evaluation Functions in the Management of Adult Education Programmes for Enhancing Teaching Strategies in Learning Centres.

The results on table 3 revealed that all the respondents agreed that all the items are the evaluation functions in the management of adult education programmes for enhancing teaching strategies in learning centre. Among these functions are: measuring the facilitators and coordinators input in learning centres; adequate evaluation mechanism of facilitators by the supervisors; evaluating achievements of learners at the end of their programmes; checking goal achievements at the end of the programme; monitoring the facilitators and coordinators regularly. The hypothesis results revealed that the respondents indicate no significant differences in their mean ratings on the evaluation functions in the item statements. The finding is in line with the study of Mgbodile, (2004) who observed that evaluation can be directed into two main areas, namely; adult education programmes and workers' performance. Further, the author maintained that managers could assess facilitators using evaluative methods like observation, visiting a classroom, or conducting interviews.

Conclusion

The study on planning and evaluation functions in the management of adult education programmes for enhancing teaching strategies in learning centres in South-East States Nigeria was carried out. The planning functions among others includes: arranging for conducive learning centres including input for facilitators and output to learners. The evaluation functions among others includes: measuring the facilitators and coordinators input in learning centres; adequate evaluation mechanism of facilitators by the supervisors; evaluating achievements of learners at the end of their programmes. However, enhancing teaching strategies depend on proper management of adult education programmes using the above identified management functions.

Limitations of the study

The study was carried out in South- East States, Nigeria. May be a more broad study of all the geopolitical zones could have given a more comprehensive result since the problem affected all the geopolitical zones in the country.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Government and stakeholders should restructure adult and non formal education programmes for effective result.
2. Formative and summative evaluation should be employed in order to make adult education programmes more effective.

Recommendations for Further Research

The study could be replicated by further researchers in other geopolitical zones in Nigeria such as: South- South, North Central, North East, North West and South West

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EFFICACY OF PROBLEM-BASED LEARNING ON ACADEMIC PERFORMANCE OF ELECTRONIC WORK STUDENTS WITH LOW ABILITY

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Abstract

This study determined the efficacy of problem-based learning on the performance of low-ability students of electronic work in technical colleges. The study adopted a quasi-experimental design. The population of the study was 124 National Technical Certificate II students with low ability records in all the technical colleges offering Electronic Work in Enugu State, Nigeria. 62 students were assigned to the experimental group, and 62 students constituted the control group. Two research questions and hypotheses, tested at 0.05 level of significance, guided the study. The Electronic Work Academic Performance Test (EWAPT) was used for data collection. The inter-rater reliability was employed to determine the reliability of the EWAPT. The inter-rater reliability was calculated using Spearman Rho correlation coefficient. The rank order correlation coefficient was found to be 0.89. Mean was used to answer the research questions, while ANCOVA was employed to test the hypothesis. The study found that problem-based learning is more effective in improving students' performance in electronic work. The study found that there was no significant difference between the mean performance scores of low and high ability students. This implies that the effectiveness of the treatment on technical college students' performance in electronic work does not depend on their ability status. It was recommended, among others, that electronic teachers should adopt problem-based learning in teaching electronic technology.

Keywords: Problem-based learning, Academic performance, electronic work, low ability

Introduction

Electronic work is one of the engineering trades taught in the technical college with the goal of training skilled technical manpower equipped with the necessary skills for diagnosing and repairing faults in electronic systems (Orji & Ogbuanya, 2018). Electronic work is also geared towards the production of craftsmen and advanced craftsmen who have the skills, attitude and knowledge to meet the demand and the development in the electronic industry to achieve the national goal of producing middle-level and skilled manpower. Electronic work covers basic electricity, electronic circuit and devices, radio communication, radio and audio frequency amplifiers, satellite transmissions/reception, and television offered in technical colleges (Shuaibu & Kamin, 2019).

Technical colleges are regarded as the basic vocational institutions in Nigeria. Technical college is a segment of Technical Vocational Education and Training (TVET) saddled with the responsibility to produce craftsmen and master craftsmen at the advanced

craft level (Olelewe, Doherty, Orji, & Aneyo, 2021). It is expected that successful graduates will be enterprising and self-reliant with skills on how to operate, maintain and repair electrical and electronic equipment, among others. Thus, in training students for electronic system diagnosis, maintenance and repair require effective teaching and learning in electronic work. However, the literature shows that the academic performance of electronic work students is not as anticipated (Orji & Ogbuanya, 2018). In addition, low ability students' poor academic performance remains at the forefront of academic concern to researchers (Orji, 2015). However, the priority in these concerns is the need to improve the academic performance of low ability students to enable them to succeed after graduation in electronic work (Orji & Ogbuanya 2018).

Academic performance implies students' performance in practical skills tasks. Thus, achievement performance refers to achievement attained by a student in practical skills task as represented by a score or mark obtained in a performance test (Omeh, & Olelewe, 2021). Previous studies (Kayode, 2009; Orji 2015; Orji & Ogbuanya, 2022) report that a skill gap exists between schools and work place in Nigeria and what is required to close this gap is the cultivation and reinforcement of relevant skills and attitude during training. However, despite the previous studies, little is known about how students centred learning, like problem-based learning, might improve electronic students' academic performance. This indicates an important research gap that should be explored systematically.

The author tends to fill this research gap looking at the best instructional approach that can influence the performances of students, especially the low achieving ones. The approach if adopted may improve the academic performance of electronic work students. Previous studies (Agbayewa, 1996; Orji 2021; Orji & Ogbuanya, 2022) have reported that problem-solving technique such problem-based learning, either as a teaching strategy or as a self-learning technique, has been found to be useful in teaching students and can improve electronic student's academically purposeful practical skills activities.

Problem-based learning (PBL) has gained popularity in recent years as an alternative to lecture and demonstration. Savery (2015) defined PBL as a learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge/skills such as problem-solving, creative thinking, collaborative skills and self-directed learning skills to develop a viable solution to a defined problem. Orji (2015; 2021) conceptualize PBL as a learner-centred pedagogical approach in which a real problem scenario or task serves as a stimulus for applying problem-solving, collaborative and self-directed learning skills. Previous PBL studies (LaForce, Noble, & Blackwell, 2017; Orji, 2021) have shown that students exposed to PBL indicate a high capacity for skills development, attitudes, and adoption of a deeper approach to learning, which might be the reason for its effectiveness in enhancing students' achievement in many disciplines. PBL has been used successfully in teaching some areas of electrical and electronic technology education (Mantri, 2014; Orji, 2015, 2021; Orji & Ogbuanya 2018, 2022). Thus, the PBL approach can be adopted to facilitate electronic work student's practical skills tasks.

While previous studies (e.g., LaForce, Noble, & Blackwell, 2017; Orji, 2021) have found that PBL may enhance student academic performance learning, less is known about the effect of PBL in improving the academic performance of electronic work on students with low ability, especially in developing countries like Nigeria. Therefore, the present study determines the efficacy of problem-based learning on the academic performance of electronic work students with low ability. Theoretically, the present study hinges on constructivist learning theory, which helps the teacher to create a context for learning in which students can become engaged in interesting activities (Vygotsky, 1978).

Overall, our study contributes to the increasing problem-based learning and student academic performance literature by hypothesising and testing the efficacy of problem-based

learning among electronic work students in technical colleges in Nigeria. Using intact class data from technical college students, the author applied a vigorous empirical analysis on a set of complementary research questions and hypotheses:

Research Questions

1. What is the effect of problem-based instructional strategy on students' academic performance in electronic work?
2. What is the effect of problem-based instructional strategy on the academic performance of low ability students in electronic work?

Hypothesis

1. There is no significant difference between the mean academic performance scores of experimental and control groups in electronic work in technical colleges.
2. There is no significant difference between the mean academic performance scores of low and high ability students exposed to PBL in electronic work in technical colleges.

Methodology

A quasi-experimental design was used for this study. Specifically, a pre-test, post-test, non-equivalent control group design was adopted for this study. According to Gall, Gall and Borg (2007), quasi-experimental design can be used when it is not possible for the researcher to randomly sample the subject and assign them to treatment groups without disrupting the academic programmes of the schools involved in the study. Therefore, this design was considered suitable for conducting this study because intact classes (non-randomized groups) were assigned to the two different groups in order to determine the effect of problem-based learning on students' achievements in electronic work. Hence, the design of the study is symbolically presented as follows:

| | Pre-test | Independent Variable | Post-test |
|---------------|----------------|----------------------|----------------|
| Exp. group | Q ₁ | x | Q ₂ |
| Control group | Q ₁ | ---- | Q ₂ |

Area of the Study

The study was conducted in the Enugu State in Nigeria. The state has two National Board for Technical Education (NBTE) accredited Technical Colleges offering electronic work whose students were studied. The technical colleges are: Government Technical College (GTC) Enugu and Government Technical College (GTC) Nsukka. Each of the schools is equipped with the facilities and equipment required for this study. The study was carried out in Enugu State because it harbours numerous industries that require the services of well-trained electronic work craftsmen produced in technical colleges.

Population for the Study

The population for the study consisted of 124 National Technical Certificate level two (NTC II) students in the two technical colleges offering Electronic Work trade in Enugu State. The year two students were used because they have been exposed to all the technical courses including electronics, and have chosen electronics as their area of interest. The entire population of 124 was used for the study. The population of students, which was provided by

the principals of each school, was gotten from schools register for 2016/2017 academic session.

Sampling and Sampling Technique

The entire population of 124 technical college students was used for the study. However, a simple random sampling technique was used to assign classes to the intervention and control groups, respectively.

Data Collection Procedure

The instruments that were used for data collection in this study were the electronic work Academic Performance Test (EWAPT). The EWAPT was also developed by the researcher. It was used to test the students' academic performance in electronic work and contains a list of specific practical tasks that students carried out. The practical tasks were based on the content of the electronic works NABTEB syllabus. A scoring guide was also developed for the EWAPT, which was used by the examiners to rate the students' performance in the practical tasks. In preparing the tests, the researcher prepared a table of the specification to serve as a guide for the test development. The table of the specification was subdivided into content and ability process dimensions. The content dimension contained the units that were taught in this study, while the ability process dimension was subdivided into lower cognitive and higher thinking processes.

In addition to the main instrument of the study, the researcher prepared two sets of lesson plans for teaching the units set out for the study. The problem-based lesson plans were used for the experimental group, while lecture based lesson plans were used for the control group. The researcher also developed a student's guidebook and group activity data sheet on problem-based learning. This afforded the teachers the opportunity to guide the students in following and mastering the necessary skills they needed to acquire for the effective application of problem-based learning during the treatment. In the lesson plans, the researcher outlined the objectives to achieve in behavioural terms. The expected teachers' and students' activities were stated as well as the approaches to be adopted for the purpose of evaluation.

Reliability of the Instrument

The reliability of the EWAPT was established after the corrections suggested by the experts were affected and incorporated into the final draft of the instrument. EWPAT was pilot tested on electronic work year II students in Federal Government Technical College (FSTC) Awka, Anambra State. The school and the students did not form part of the study. The inter-ratter reliability was employed to determine the reliability of the EWPAT in which two ratters used the scoring guide to rate 20 students in a pilot test class on their psychomotor skills. The inter-ratter reliability was calculated using spearman's rho correlation coefficient. The rank order correlation coefficient was found to be 0.89. This indicates that there was high agreement between the two ratters who rated the students.

Experimental Procedures

The pre-test was first administered before the commencement of the treatment. Already specified electronic work trade classrooms were used for the process of teaching/learning and the students made use of the relevant materials about the topic discussed in the classroom. Each formal session followed the same pattern:

1. One of the students was appointed to chair the proceedings and another acted as the scribe. The roles were changed for each problem. The students conducted the

class session. A facilitator (teacher) trained in PBL was present to guide their activities.

2. The teacher debriefed the problem set in the previous period. The second part was a briefing on the new problem.
3. The briefing element started with the students being given a written problem or scenario.
4. The leader of the group read out the problem and the group identified the significant content of the problem that required understanding. A degree of understanding emerged, but additional goals were identified. The groups identified their own learning objectives. The facilitator was present to ensure that the groups remained focused and that the correct set of learning goals were identified using the lesson plans prepared by the problem writer at the time the problem was drawn up which contains all the specific objectives the students are expected to identify.
5. After the first part of the group session, the groups presented the result of their findings.

The experimental group was taught in 5 lessons using problem-based learning approach, while the control group was also taught the same 5 lessons with the lecture method. Each lesson lasted for ninety (90) minutes and the treatment lasted for one month and one week.

Method of Data Collection

The regular class teachers administered the pre-test to their students in the two groups. After the pre-test, treatment was administered to the subjects by their regular class teachers also. At the end of the treatment, the post-test was administered, supervised, and graded by the teachers that taught the groups using the scoring guides developed by the researcher. The scores of the experimental and control groups in both pre-test and post-test was recorded and compared to check if there is any significant difference in the achievement of the groups.

Data Analysis

The data collected from the administration of pre-test and post-test were analysed using mean scores to answer the research questions. The pre-test and post-test mean gain of the two groups were computed. The marginal mean values of the students were computed to determine the effect of treatment on achievement to answer the research questions.

The hypotheses formulated for the study was tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). According to Ary, Jacob and Razavieh (2002) ANCOVA is a statistical technique used to control for the effect of an extraneous variable known to be correlated with the dependent variables. The statistical package for the social sciences (SPSS) version 16 was used for all the data analysis in this study. The decision to answer the research questions was based on the mean gain score. If the mean gain score of the experimental group is greater than the control, it means that the treatment has an effect. For the hypotheses, if the probability value (p) for the group obtained after data analysis is less than or equal to the 0.05 alpha value at which it is being tested, it means that there is a significant effect of the treatment. But if the (p) value is higher than the 0.05 alpha value, it means that there is no significant effect of the treatment.

Results

The result presented in Table 1 shows that the experimental group had a mean achievement score of 11.30 and a standard deviation of 2.70 in the pre-test and a mean

achievement score of 22.62 and standard deviation of 2.70 in the post-test, making a pre-test, post-test mean gain of 11.32. The control group had a mean achievement score of 12.38 and standard deviation of 2.85 in the pre-test and a mean score of 18.02 and standard deviation of 2.69 in the post-test with a pre-test, post-test mean gain of 5.64. This implies that problem-based learning is effective in improving students' academic performance in electronic work better.

Table 1: Mean and Standard Deviation of pre-test and post-test of Electronic Work Academic Performance Scores of students Taught using problem-based learning and Conventional Method.

| Groups | N | Method | Pre-test | | Post-test | | Mean gain score | Difference |
|---------|----|--------|-----------|------|-----------|------|-----------------|------------|
| | | | \bar{X} | SD | \bar{X} | SD | | |
| Expt. | 62 | PBL | 11.30 | 2.70 | 22.62 | 2.70 | 11.32 | 5.68 |
| Control | 62 | LM | 12.38 | 2.85 | 18.02 | 2.69 | 5.64 | |

Similarly, the results presented in Table 2 show that the F-value for the effect of problem-based learning on students' academic performance is 2.102 with a significant of F at .149, which is higher than the level of 0.05 alpha value at which it is being tested. The null hypothesis is, therefore, not rejected at 0.05 level of significance. The result implies that there is no significant difference between the mean academic performance scores of the experimental and control groups.

Table 2: Summary of Analysis of Covariance (ANCOVA) for the test of significance of the effect of Treatments with respect to their mean scores in Electronic Work Academic Performance Test (EWAPT).

| Source | Sum of Squares | Df | Mean Square | F | Sig. |
|------------------------|----------------------|------------|-------------|---------|-------|
| Corrected Model | 987.384 ^a | 3 | 329.128 | 57.973 | .000 |
| Intercept | 1114.449 | 1 | 1114.449 | 196.299 | .000 |
| GROUP | 11.932 | 1 | 11.932 | 2.102 | .149* |
| PRETESTPAT | 220.427 | 1 | 220.427 | 38.826 | .000 |
| GROUP * PRETESTPAT | 7.119 | 1 | 7.119 | 1.254 | .265 |
| Error | 806.177 | 124 | 5.677 | | |
| Total | 59874.000 | 124 | | | |
| Corrected Total | 1793.562 | 123 | | | |

*Significant at sig of F < .05

The result presented in Table 3 shows that experimental group had a mean achievement score of 10.61 and a standard deviation of 2.06 in the pre-test and a mean achievement score of 21.97 and standard deviation of 2.94 in the post-test, making a pre-test, post-test mean gain of 11.36. The data in the same table also revealed that the control group had a mean achievement score of 12.30 and a standard deviation of 3.40 in the pre-test and a mean score of 17.81 and a standard deviation of 2.50 in the post-test with a pre-test, post-test mean gain of 5.51. This means that the low ability students taught with problem-based learning perform better than those taught with the conventional lecture method.

Table 3: Mean and standard Deviation of pre-test and post-test Academic performance Scores of Low Ability Students taught with problem-based learning and Conventional Method.

| Groups | N | Method | Pre-test | | Post-test | | Mean gain score | Difference |
|---------|----|--------|-----------|------|-----------|------|-----------------|------------|
| | | | \bar{X} | SD | \bar{X} | SD | | |
| Expt. | 62 | PBL | 10.61 | 2.06 | 21.97 | 2.94 | 11.36 | 5.85 |
| Control | 62 | LM | 12.30 | 3.40 | 17.81 | 2.50 | 5.51 | |

The results presented in Table 4 show that the F-value for the effect of problem-based learning on students' academic performance is .422 with a significant of F at .518, which is higher than the level of 0.05 alpha value at which it has been tested. The null hypothesis is therefore, not rejected at 0.05 level of significant. The result implies that there is no significant difference between the mean academic performance scores of low and high ability students.

Table 4: Summary of Analysis of Covariance (ANCOVA) of students' low and high ability in Electronic Work Academic Performance Test (EWAPT).

| Source | Sum of Squares | Df | Mean Square | F | Sig. |
|------------------------|----------------------|------------|-------------|---------|-------|
| Corrected Model | 811.746 ^a | 6 | 135.291 | 22.772 | .000 |
| Intercept | 838.955 | 1 | 838.955 | 141.214 | .000 |
| ABLEVEL | 2.506 | 1 | 2.506 | .422 | .518* |
| GROUP | 8.684 | 1 | 8.684 | 1.462 | .229 |
| PRETESTPAT | 142.695 | 1 | 142.695 | 24.019 | .000 |
| ABLEVEL * GROUP * | 13.381 | 3 | 4.460 | .751 | .524 |
| PRETESTPAT | | | | | |
| Error | 611.927 | 124 | 5.941 | | |
| Total | 46066.000 | 124 | | | |
| Corrected Total | 1423.673 | 123 | | | |

*Significant at sig of F < .05

Discussion of Findings

The purpose of this study was to determine the efficacy of problem-based learning on academic performance as well as its effect on low ability students in electronic work. The data presented in Table 1 revealed that the effect of problem-based learning in improving students' academic performance in electronic work is higher than the conventional method. The result indicates that problem-based learning is more effective in improving students' academic performance in electronic work than the lecture method. However, analysis of covariance was used to test the second hypothesis (Table 2) at the calculated F-value (2.102), significance of F (.149) and confidence level of .05. It is glaring from the results of the study that there was no significant difference in the performances of students in the three ability levels after receiving the problem-solving strategy. This implies that all the students in the different ability levels were able to solve problems based on the diode, zener diode and transistor concepts after the treatment. This is in line with the findings of Adesoji (1995, 1997); Orji, (2015), and Orji & Ogbuanya, (2018) who observed that problem-solving strategies were effective in teaching students of different ability levels. The ability to solve problems in electronic work could therefore be enhanced by introducing a good teaching strategy. Thus, it could be said that solving problems is not limited to a particular ability level.

This finding seems to also confirm Bello's (2011) position that students exposed to group instructional strategy performed better than their counterparts in individual learning treatment classes while learning and teaching with visual aids to students in groups get a better result and Zemke, Elger and Beller (2004) who found that students overwhelmingly indicated that use of effective cooperative events enabled them to, more easily, master difficult material. Furthermore, those who worked in a small group were better motivated to learn, and this might be a result of better accessibility to the teacher during teaching-learning process than when one is in a whole class where there are many students. Also, there is much more discipline in having to listen and have total attention to learning in the problem-based learning class than when one is in a conventional class and being able to interact with the teacher by asking questions and interacting with others during the discussion in the class, knowing that knowledge does not belong only to a person.

The data presented in Table 4 provided the answer to hypothesis two. It was revealed that the effect of problem-based learning in improving low ability students academic performance in electronics work is higher than the conventional method. Thus, the result indicates that problem-based learning is more effective in improving low-ability students' academic performance in electronic work. However, analysis of covariance was used to test the hypothesis at the calculated F-value of .288 and .422, significance of F .230 and .518 at a confidence level of .05. It was revealed that the mean difference between the effect of problem-based learning on low and high ability students' academic performance in electronic work was not statistically significant. Hence, the null hypothesis of no significant difference was not rejected. This result, therefore, means that there was no significant mean difference between the effects of problem-based learning on low and high ability students' academic performance in electronic work. This result implies that problem-based learning is more effective in improving the performance of low ability students in academic performance regardless of the ability group the students belong to.

This finding is similar to the finding of Adesoji (2008), who compared the effectiveness of problem-solving instructional strategy and students' ability levels and reported that there was no significant difference in the performances of students in the ability levels after receiving the problem-solving strategy. This implies that, all the students in the different ability levels were able to solve problems based on electrolysis and its prerequisite concepts after the treatment. This was in support of Adesoji (1995, 1997), who observed that problem-solving strategies were effective in teaching students of different ability levels. Ability to solve problems in science could therefore be enhanced by introducing a good teaching strategy.

Implications of the Study

The findings of this study have implications for Electronic Work Teachers and Curriculum planners and the Government. The study found out that problem based instructional strategy is more effective in improving students' academic performance. There is need for technical teachers to adopt this problem based instructional strategy in the teaching of cognitive and psychomotor skills to electronic work students. In addition, appropriate curriculum that should be developed to make provision for adoption of problem based instructional strategy for teaching electronic work to technical college students. Finally, the government should see the need to improve its funding of technical and vocational education so that craftsmen graduating from technical colleges in Nigeria will contribute more effectively to national development.

Conclusions

The present rapid development in electronic technology development which has led to the complexity and difficulty in carrying out diagnosis, maintenance and repair of electronic gadgets by technical college students has given rise to the need for the use of problem-based learning in order to assist electronics graduates in acquiring adequate skills necessary for employment in the changing workplace. Consequent upon this, the study determined the effect of problem-based learning on the academic performance of low ability students of electronic work in technical colleges and found that problem-based learning is more effective than the conventional method in enhancing students academic performance in electronic work. The study however found no significant difference between the mean academic performance of low and high ability students in electronic work. This implies that the effectiveness of problem-based learning in improving students achievement does not depend on the ability level of students. It therefore means that problem-based learning is a dependable option for teaching and learning in the present era of rapid technological

development as it promotes active and efficient learning, which can lead to the acquisition of necessary skills for employment.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Workshops, seminars and conferences should be organised by State Science and Technical Schools Board to enlighten and train electronic work teachers on the application of problem-based learning for improving students' achievement in studying electronic work.
2. National Board for Technical Education (NBTE) should consider the review of the curriculum for electronic work to incorporate activities that reflect problem solving to enable students to learn more effectively.
3. The use of PBL should be adopted by teachers and school administrators in order to promote meaningful learning in electronic work.
4. Teachers training programmes should in-cooperate the teaching of pre-service teaching in the use of PBL. This will enable them to impart the use of the strategy to their students after graduation.
5. Authors of technical textbooks should write their texts to be learner centred and activity oriented, as in PBL. This will help in facilitating understanding and meaningful learning in the trade.
6. Teachers and curriculum planners should develop an interest in the use of problem-based learning as a method of teaching electronic work in technical colleges.
7. PBL should be used for the teaching of electronic work and other engineering trade subjects.

Suggestion for Further Study

A similar study should be carried out using a larger population in the universities in Nigeria.

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UNDERGRADUATE MATHEMATICS STUDENT'S ERRORS WHEN SOLVING SYSTEMS OF LINEAR EQUATIONS

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Abstract

This study focussed on the difficulties that undergraduate students face while learning the concepts on solving systems of linear equations in linear algebra. The concept of the system of equations plays a crucial role in linear algebra and is applied to other branches of mathematics. We focused on the application of the Gaussian Elimination method when checking whether a given system of equations is consistent or inconsistent. The participants were 15 first-year students studying for a Bachelor of Science Education Honours Degree in mathematics. The study was qualitative in nature. Data were generated from students' responses to a written task. Structured interviews based on the Gaussian Elimination method and further probing of students' responses to the written task were also used to solicit more information. The study findings show that the concepts were rather difficult, as evidenced by the errors committed, such as conceptual, procedural and computational. Many of the students struggled with the forward part of Gaussian Elimination and failed to come up with the correct argument on whether the system of equations is consistent or inconsistent. We recommend that mathematical education instructors need to dwell much on aspects of the types of augmented matrices that give rise to unique solutions, many solutions or no solutions.

Keywords: Systems of linear equations, Errors, Misconception, Undergraduate students

Introduction

The concept of solving systems of linear equations plays a central role in many linear algebra concepts and it is also applied to other branches of mathematics. It is also a central topic that transit from elementary algebra to Linear algebra (Warren et al., 2016). Early researchers such as Dorier (2000) outlined that the development of linear algebra begins with the work on solving simultaneous systems of the linear equation of form $2x + 3y = 2$ and $4x - 6y = 4$. These were the ideas behind the work of Leonard Euler's during the 18th century, who further inspected whether the square matrix has unique solutions or not. According to Stewart and Zandieh (2019), research on the teaching and learning of linear algebra started in 1980, and mathematics education researchers were concerned and worried about students' difficulties in understanding the various concepts in linear algebra. These early researchers who were disheartened by students' performance included Dorier (2000), Klapsou and Gray (1999), Carlson (1993). These authors argued that the high level of formalisation plays a greater part of the difficulties that were experienced by the students with Carlson (1993) outlining that it as if a "heavy fog has befallen them".

In recent years more studies have been conducted in order to try to explain why students still struggle with the various linear algebra concepts. A number of researchers used APOS theory such as Ndlovu and Brijlall (2019), Kazunga and Bansilal (2020) to explain undergraduate mathematics students' mental constructions of concepts. Despite these studies, students still struggle to understand many of the concepts in linear algebra. This is consistent with Warren et al. (2016), who argued that many researchers have paid attention to students

understanding when solving linear equations, and little research has focused on solving the system of equations and inequalities. Furthermore, Stewart and Zandieh (2019) also commented that many of the studies in linear algebra focused on abstract vector spaces and subspaces and few studies looked at solutions of systems of equations, determinants, null and column spaces. Stewart et al. (2022) outlined that it is necessary to continue researching the teaching and learning of linear algebra as it provides new insights into better ways for students understanding of the subject. Thus, this study contributes knowledge on undergraduate students' misconceptions when solving linear equations amid efforts to improve teaching and learning in higher education in Zimbabwe.

The study is guided by the following questions.

1. What are the errors and misconceptions displayed by undergraduate mathematics students when working with systems of linear equations?
2. What are the strategies employed to reduce errors and misconceptions when solving systems of linear equations?

Literature review

Linear algebra is included in some university mathematics-based courses, such as the Bachelor of science in mathematics education. It is one of the courses that is abstract at university level and students often find it difficult to learn it as they usually wrestle with definitions (Mumu, 2017; Widyawati, 2018). Also, Baglely and Rabin (2016) lamented that this topic is more concerned with many concepts of advanced mathematics, which focuses more on formal proof, an abstract axiomatic structure such as the group theory and the study of concepts that are not easy to visualise such as the vector spaces. Bagley and Rabin (2016) focused their study on the kind of reasoning that students encounter when learning linear algebra and noted that students struggle to understand the concepts. Despite that Arnawa and Nita (2019) noted that the topic of solving systems of equations as part of linear algebra has important applications in the fields of science and technology such that universities should prioritise it and make sure that it is included in any syllabus at undergraduate level. Much of the literature on linear algebra outlines that students struggle to solve basic problems and having difficulties in moving flexibly between representations.

Kazunga and Bansilal (2022) used the APOS theory to analyse student understanding of solving of system of equations using the inverse matrix method. They noted that students struggled to apply Sarrus rule when finding determinant of 3×3 matrices as they fail to use

the correct transformation, for example, using $\begin{bmatrix} 1 & 2 & 0 \\ 3 & 1 & 4 \\ 1 & 0 & 2 \end{bmatrix}$. Instead of repeating the first two

rows, they simply find the product of the diagonals of the original matrix which was a misconceptions and they obtained $[(1 \times 1 \times 2) + (2 \times 4) + (0)] - [(1) + (3 \times 2) + (1 \times 1 \times 0)] = -1$. They further noted that after finding the determinant, the students needed to apply the adjoint formular method and obtain $A^{-1} = \frac{1}{\det A}$ Adjoint A. Most students used the expression $A^{-1} = \frac{1}{\det A} A^t$. Additionally Kazunga and Bansilal (2020) argued that working with linear algebra concepts involves engaging with formalisation.

On a different note, Hanna et al. (2016) argued that students can cope with the manipulation of figures involved when solving systems of equations, but they do not develop a deep understanding of these concepts and cannot apply them in new situations. Birinci et al. (2014) asserted that most students encounter symbolic errors when solving a system of equations, such as using the wrong brackets to denote matrices. He also noted that some of

the students used the “=” instead of “~” to show the successive steps when doing row operations.

Arnawa and Nita (2020) noted that for one to be confident when solving problems in linear algebra, the following stages are necessary; (1) Be able to define the given terms. (2) understand how the theorems, lemmas are derived and do practice exercises using the definition, lemmas, or theorems and that it is important for one to be creative. There are so many methods that can be used to solve a system of equations. The study is aimed at determining the errors and misconceptions that students make when solving systems of equations using the Gaussian Elimination method.

Conceptual Framework

The Newton Error Hierarchical Model proposed by Newman (1997) was used in the study. This model is appropriate to be used in categorising and identifying student errors in the learning of mathematics. The model consists of six types of errors which include reading error, comprehension, transformation, process skill, encoding error and carelessness. However, we regrouped the six types of errors according to Ndemo and Ndemo (2019) and came up with three broad categories of errors which include conceptual, procedural, and computational errors. This study will adopt the three major types of error that are discussed below:

Conceptual errors: the student reads all words in the problem accurately but does not understand the overall problem or specific terms within the problem. Ndemo and Ndemo (2019) described it as one being caused by the student’s inadequate knowledge of concepts.

Procedural errors: the student understands what the problem requires but is unable to identify the operation or the sequence of operation needed to solve the problem.

Computational errors: These are a result of calculation errors

Research Methodology

Research design

The research is pinned on the interpretivist paradigm as it aims at understanding the errors and misconceptions from the learners’ perspective (Creswell, 2014). Descombe (2014) recommended that the descriptive research design is a suitable method that will enable the researcher to obtain the opinions of the respondents. This research was qualitative in nature as it aims to understand the phenomenon from the human participants’ views.

Participants

Fifteen participants were selected for the study. The study used purposive sampling. Purposive sampling is a feature of qualitative research whereby individuals are selected on basis of possessing a particular characteristic required for the study. In this study the participants were the in-service teachers studying for a Bachelor of Science Education Honours degree in Mathematics at one University in Zimbabwe. These in-service teachers were studying the first module, where the concepts on solving systems of equations was covered.

Data Collection Methods

A structured activity sheet was used to collect the data. The data were generated from the 15 students’ written responses to one task based on the concept on solving systems of equations and this was written individually. A semi-structured interview protocol was developed after the researchers’ analysed the written responses to elicit more information that helped in understanding the students’ errors. Both the written work and interviews were used

to explore the errors that in-service teachers make when learning concepts on solving systems of equations using the gaussian elimination method. After answering the question individually, structured interviews were conducted. The questions on the activity sheet are shown in the appendices. Students were assigned “fictitious” names. Cresswell (2014) commented that the interview method is used extensively since it often yields rich data about a given case, and one can probe deeper into the thoughts of participants.

Data analysis method

The data collected by means of written questions and semi-structured interviews was analysed so that meaning would be attached to it. We identified the patterns emerging from the data (both from the written item and from the interviews). Similarities and differences in the written work were noted, leading to the development of themes and patterns. Frequency tables were drawn, and data coding was done. The following categories were noted: 1. no response, 2. some progress towards solution but far from the correct solution, 3. almost correct response with minor mistakes, and 4. totally correct responses. The types of errors were grouped into conceptual, procedural and computational errors.

Results

Question 5

The researchers first analysed the written question and then further discussed the interview questions. Table 1 below represents the frequencies of responses for question 5

Table 1

Frequency of scores for question 5

| Category | 1 | 2 | 3 | 4 |
|------------------------|----------------------------------|---|---|---------------------------|
| Indicator | No attempt, or totally incorrect | Struggling to carry out elementary row operations | Almost correct response, but failed to completely carry out row reduction, or wrong conclusions | Totally correct responses |
| Number of participants | 4 | 7 | 4 | 0 |

From the written response, we noted that none of the students was able to get a completely written response together with the correct conclusion. Additionally, we noted that 4 of the students were able to come up with the correct augmented matrix. Correct row operations are seen as evident in student A14 written response.

Figure 1

Written response by student A14

$$\begin{aligned}
 f + g - 2h &= 0 \\
 2f + 2g - 3h &= 1 \\
 3f + 3g + h &= 2
 \end{aligned}$$

$$\begin{pmatrix} 1 & 1 & -2 \\ 2 & 2 & -3 \\ 3 & 3 & 1 \end{pmatrix} \begin{pmatrix} f \\ g \\ h \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 1 & -2 & | & 0 \\ 2 & 2 & -3 & | & 1 \\ 3 & 3 & 1 & | & 2 \end{pmatrix} \begin{array}{l} -2R_1 + R_2 \rightarrow R_2 \\ -3R_1 + R_3 \rightarrow R_3 \end{array}$$

$$\begin{pmatrix} 1 & 1 & -2 & | & 0 \\ 0 & 0 & 1 & | & 1 \\ 0 & 0 & 7 & | & 2 \end{pmatrix} \frac{1}{7}R_3 \rightarrow R_3$$

$$\begin{pmatrix} 1 & 1 & -2 & | & 0 \\ 0 & 0 & 1 & | & 1 \\ 0 & 0 & 1 & | & 1 \end{pmatrix}$$

$$h = 1 \quad 0.f + 0.g + h = 1 \quad \therefore h = 1$$

Consistent, unique solution

In Figure 1 we can see that the student is able to write down the coefficients of the unknown in matrix form and then augments with the constants that appear on the right-hand side as an additional column that is of the form $Ax = b$. Correct procedures are seen as the student is able to produce zeros below the first entry in the first column, thereby translating into eliminating the first variable x from the second and third equations as well as the y variable. The student could correctly add a multiple of one row to another row. Finally, a correct procedure is evident when the student A14 is able multiply a row by a constant $\frac{1}{7}$ so as to create a 1 in that row. However the major aim of carrying out Gaussian elimination is to transform or reduce the augmented matrix into the form $(A'|b')$ where A' is upper triangular ($a_{ij}' = 0$ for $i > j$), that is any zero rows that appear at the bottom of the matrix, and the first non-zero entry in a higher row, such a matrix is said to be in echelon form. Thus, the forward part of Gaussian elimination was not complete. Student A1, A8 and A12 carried the same row operations as A14 and did not complete the row operations. This revealed that these students manifested a procedural error by failing to express the solution in an appropriate way.

Student A14 also did not make the correct argument by stating that the system gives a unique solution. The response revealed some knowledge gaps in the work being done. The student also stated that the solution was consistent, which was incorrect. Student A8 said the system is inconsistent but failed to make the last row having zeros, whilst student A12 simply said there are many solutions without stating whether it is consistent or inconsistent. This further shows that the student could not display the correct knowledge when solving systems of equations. Student A1 concluded that it is inconsistent and has infinitely many solutions. This shows that the students had a collection of the procedures on how to solve a system of equations, but they displayed some conceptual errors by failing to make the proper

conclusion on whether the solution was consistent or inconsistent. The following exchanges took place with student A14 to check whether he still cling to his misconception

R: Looking at you written work, which method did you use?

A14: I used Gaussian elimination method

R: Oh ok. So why didn't you transform or reduce the matrix to row echelon form

A14: I did maam, and was able to do back substitution and obtain $h=1$.

R: This is not reduced. Can't you have the last row being zeros

A14: Oh I see, but when I reduced it, I thought it is the final stage

R: So, if the last row is zero, is the system consistent or inconsistent.

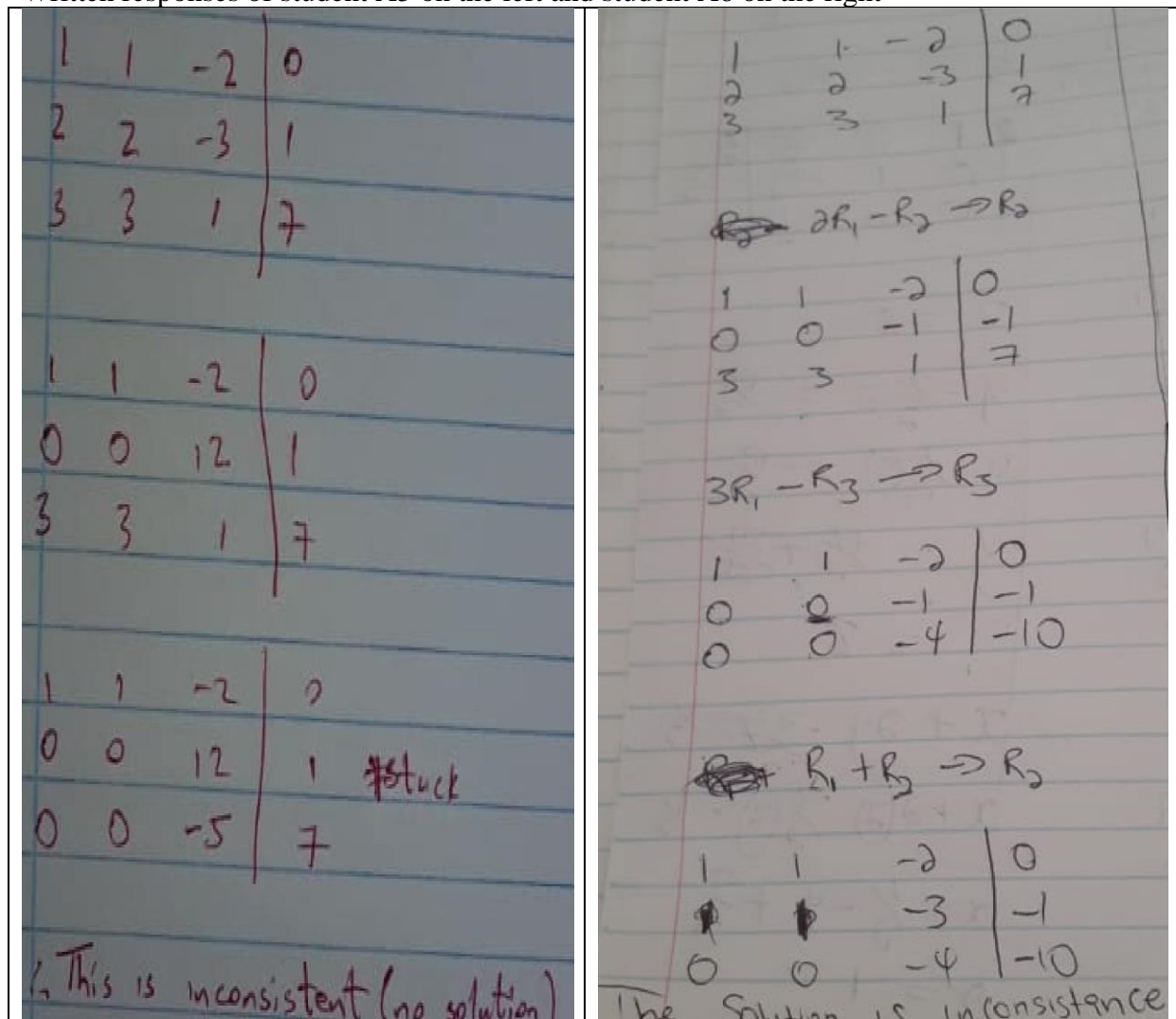
A14: Hmmm I am not sure here. I think it is inconsistent and has many solutions

When the student was interviewed, the response showed a lot of knowledge gaps in the work covered.

The students in category 3 struggled to carry out elementary row operations. They showed some difficulties in answering the question, and they demonstrated a number of errors. This is evidenced by students A5 and A6 written responses shown in Figure 2.

Figure 2

Written responses of student A5 on the left and student A6 on the right



From the written response, student A5 did not bother to write down the row operations that he manipulated. That value 12 in the second matrix has been wrongly manipulated. Furthermore, the students failed again to simplify correctly the element in the third-row third column of the third matrix. Instead of getting a 7, the student got a -5. This revealed that the student shows incompetency in his calculations, thus displaying calculation errors. The student further shows that he was struggling as he wrote that he was stuck. The elementary row operations are not complete, revealing procedural errors and also basing on his solution, the conclusion is not correct, thus displaying conceptual errors. Student A6 was able to write down the row operations that he operated. However, the student seemed to have some careless errors in the manipulation of figures. The row operation $3r_1 - r_3$ is correct but $3(-2) - 1 = 7 \neq -4$ and also $3(0) - 7 = -7 \neq -10$. The student further showed much confusion on the work being done as he provided a totally erroneous row operation that is $r_1 + r_2 \rightarrow r_2$. The operated r_2 already has zeros below the leading elements, but the operated row operations show that the student could not unpack the structure of echelon form and further reveal that he did not understand the concept. Student A2, A3, A9 and A11 also carried out wrong operations and had wrong deductions. This showed that these students demonstrated procedural errors. Student A15 came up with the following as his final solution $\begin{bmatrix} 1 & 1 & -2 & : & 0 \\ 1 & 1 & -1 & : & 1 \\ 0 & 0 & 1 & : & 1 \end{bmatrix}$ and concluded that it is consistent and unique. These demonstrated that these students could not apply the correct strategies' thus demonstrating procedural and conceptual errors.

Students A7, A10 and A13, did not attempt the questions and they admitted that the terms consistent and inconsistent confused them and they could not figure out the method that they were supposed to use. These students displayed conceptual errors. Another student, A4 also struggled to solve the equations, as shown in figure 3.

Figure 3

Written responses of student A4

Handwritten work by student A4:

$$\begin{aligned} \textcircled{7} \quad & f + g - 2h = 0 \\ & 2f + 2g - 3h = 1 \\ & 3f + 3g + h = 7 \end{aligned}$$

$$\begin{aligned} & \left(\begin{array}{rcl} f + g - 2h & = & 0 \\ 2f + 2g - 3h & = & 1 \end{array} \right) \begin{array}{l} \text{addition} \\ \text{subtraction} \end{array} \\ & \hline & -f - g - h = 1 \end{aligned}$$

Substitute into 3

The student knew that he could use the elimination method, but he applied the wrong strategy. The student was able to read the question fluently but proceeded to simply subtract the two equations. This response contradicts the assumptions that are made in the question confirming that the student had not internalised the concepts of solving systems of equations using Gaussian Elimination method. The student demonstrated a conceptual error. During interview the following exchanges took place:

R: How do you show that a given system of equations is consistent or inconsistent?

A4: You simply subtract equation 1 from equation 2 and then you substitute the result in the remaining equation into the third equation.

R: How do you substitute it, and which method are you using?

A4: I will make f the subject of the formulae and then substitute. I use the elimination method.

R: Looking at the two equations, what did you eliminate?

A4: Ummm not sure now

The discussion shows that the student was still clinging to his misconception. In his mind, the student wanted to generalise his knowledge about a 2×2 system of equations but could not cognitively observe that he could not even solve the two equations simultaneously correctly. He had constructed an incorrect concept image on how to solve the system of equations.

Interview Questions

Students were asked four structured questions on the concept of solving systems of equations by the Gaussian Elimination method. This was performed so that we get an understanding of how the students construct the ideas of systems of the system of equations and try to figure out the types of errors that they reveal whilst working on such problems.

1. What is the other term for Gaussian Elimination?

Students struggled to find other terms for describing Gaussian Elimination. We noted that 5(33%) of them said that it is the Gauss Jordan. It shows that these students did not understand the difference between these two methods and the relationship between them when solving systems of linear equations. The students also gave answers that included the following terms, “reduction”, “row operations”, and “part of the augmented matrix”. The students were outlining part of the procedures that are involved. One student admitted that he did not read about it, with two of the students remaining silent. These students manifested conceptual errors.

The following exchanges took place with student A1

R: May you state the other name for Gaussian Elimination.

A1: Hmm, I think it is reduced row echelon form

R: Isn't it reduced row echelon linked to Gauss Jordan elimination

A1: Oh yes yes. I think its row echelon form, I always confuses the two

R: What is the difference between these methods

A1: Not so sure Maam but in one of them we form an upper triangular matrix and the other on we have zeros above and below the matrices and then ones on the main diagonal

From the discussion, it shows that the students confused the terms Gaussian Elimination and Gauss Jordan elimination as well as the terms reduced row echelon form and row echelon form. However, student A1 after some probing was able to state the other name for Gaussian Elimination method but could not distinguish the two methods.

2. State the three Gaussian Elimination rules that we follow when we perform row operations.

Three students got all the rules correctly. Student A3 indicated the question was difficult for him. Five of the students attempted to outline the procedures of Gaussian

Elimination. All these students revealed conceptual errors as they could not state the rules correctly; for example, the following exchanges took place with the following three students.

A4: The first one is you have to change it to an augmented form. The second one is you have to change it to row operation form, and then the diagonals must be equal to one.

A5: The diagonals in the augmented matrix must be 111 and the numbers below the zeros must be zeros

A14: The first one is the Crammers rule, the second is that of the inverse, thirdly is the reduced row operations

Students A4 and A5 resorted to some procedural explanations instead of simply stating the three rules. When further probed, these students really showed that they have only memorised the procedures without really articulating the concepts. Student A14 seemed to use guesswork though the terms that he suggested hang around the concepts on solving systems of equations but have been misplaced. The students displayed conceptual errors.

What is the difference between consistent and inconsistent systems of equations?

Here we noted that only two students got the correct response. 5 students admitted that they didn't read anything about this but just knew how to do calculations. The following exchanges took place with some of the students who struggled to state the difference between the two terms.

A4: A consistent is the equation that can have one solution, it has one value for x and one value for y . Inconsistent is the equation that has no solution

A13: When its consistent is whereby there is a value of x and y . If it is inconsistent, it is whereby $y = 0$ and $x = 0$. It is no solution.

R: Its not very clear, which one has solutions, and which one doesn't have solutions? If you solve a system of equations and get zeros does it mean it does have a solution?

A13: Inconsistent is whereby it has no solution

R: Then consistent

A13: Is whereby it has solutions

R: What kinds of solution

A13: One solution or unique solution

A14: Consistent is whereby we have a unique solution or one solution. Lets say $x = 4$ and $y = 4$. Inconsistent is whereby we have no solution, like we $0 = 4$ which is impossible.

R: Suppose we have got infinitely many solutions, where does it come in?

A14: That one is inconsistent

From the discussion, we can see that the students revealed that they confused the terms consistent and inconsistent. There was a misconception that consistent solutions only refers to unique solutions. Students could not figure out that if one obtains many solutions, it also falls in the consistent category. These terms were used interchangeably.

3. Explain the circumstances that give rise to unique solutions, infinitely many solutions and no solution

Students were asked how the elements look like after carrying out row reduction of an $n \times m$ matrix if it gives no solutions, unique solutions and infinitely many solutions.

Four students (27%) were able to use the constraints in the questions and made explicit explanations of the circumstances that give rise to the three different types of solutions. They

were able to state the relationships between the types of solutions and tried to come up with examples of hypothetical matrices reduced to row echelon form and tried to differentiate these different types of solutions. However, we noted that many of the students struggled to explain the circumstances that lead to those types of solutions. Some even conceded that they don't have an idea. An example is student A10 who said, "To be honest I am failing to explain, I only practised calculations." The following exchanges took place so that we were able to conduct an analysis of errors the students made when building schema of solutions to systems of equations.

A1: When its unique the determinant has a numerical value.

R: What about for infinitely many solutions and no solutions.

A1: For the augmented matrices there has to be a value when you say $\frac{Dx}{D}$, $\frac{Dy}{D}$, $\frac{Dz}{D}$ there has to be a value which is 1.

R: I believe you are now mixing this with Crammer's rule

A1: I'm confused now

A2: It has no solution if the determinant is zero.

R: Can we get the determinant of an $n \times m$ matrix.

A2: Yes we can find the determinant of any matrix, thus switching row or columns will give us no solution. This is hard.

A5: Unique is when the equation has one solution. Infinitely many is when the discriminant is hmmm is equal to zero

R: Which discriminant are you talking about?

A5: In the augmented matrix, if the discriminant is 0, then there is no solution

R: Which discriminant is this? Under Gaussian Elimination we don't talk about discriminant.

A5: I have no answer to all of this if we are not talking about discriminant.

Based on the interviews, we noted that many of the students understood these concepts in bits and pieces. Student A1 brought the idea of the Crammer's rule, which is another method that is used to solve systems of equations. Arnawa and Nita (2019) outlined that students prefer to use the Crammers rule because they think it's easier than Gaussian Elimination method and the inverse method. Student A2 also attempted to answer the question in terms of the determinant. The student failed to visualise that he could only find the determinant of an $M_{n \times n}$ and this showed that he had not conceptualised the knowledge of determinants. In addition, three students had a misconception that if one of the rows is zero, then there will be many solutions. This shows that the students did not have accurate knowledge on the circumstances that give rise to systems of equations with many solutions. The major error displayed here is a conceptual error.

Discussion of Findings

The study has reported on students understanding of the concept of solving systems of the equation using Gaussian Elimination method. The study revealed that students make errors in their written work and has proved that university students have a limited conception on the use of Gaussian elimination when solving systems of equations.

We also noted that students could not distinguish between the Gauss Elimination method and the Gauss Jordan elimination method, thus revealing a conceptual error. There was also a serious conceptual error that the students displayed when they claimed that an inconsistent system of equations gives many solutions and no solutions. Ghani et.al (2018) argued that the learning of linear algebra is abstract, and it requires systematic thinking in a rational way. It is therefore important for educators to help students understand these abstract

concepts by first understanding the errors and misconceptions that they make and teaching them using these errors, as Ndemo and Ndemo (2019) acknowledges that misconceptions and errors in linear algebra emanate from the abstract nature of the subject.

Another misconception that was displayed by these students was the use of the determinant method to check whether a system of equations is consistent or not. This finding corroborates the finding made by Arnawa and Nita (2019) that students thought that the Cramm's rule can be used to find solutions to every system of linear equations. Students need to be guided on these issues and be aware that they can only find the determinant of $M_{n \times n}$ matrix. The students manifested conceptual errors showing the inadequacy of proper knowledge of the understanding of solving of system of equations by Gaussian Elimination method. The other conceptual error that these students demonstrated was the failure to interpret the solution to the system of equations after row reduction, and they could not complete the row reduction. Many students revealed computational errors due to lack of calculation techniques and failure to manipulate directed numbers.

Conclusion

The study explored some errors that students make when learning linear algebra concepts in particular, the solving of systems of linear equations. The errors were studied through written work and structured interviews. The study findings speak to the types of errors and some misconceptions that these students make when solving systems of equations using gaussian elimination. Many of the errors displayed by the students were mainly conceptual errors, with a few procedural and computational errors. The computational errors were as a result of lack of basic knowledge of learnt concepts on simplification of directed and general algebra. The findings have implications on mathematics teacher training because these students were being trained to teach the basic concepts on linear equations at the Advanced level in secondary schools. Hence it is important to rectify the problem as the students are being trained.

Makgakga (2016) noted that it is very important that instructors should teach mathematics by considering the misconceptions and errors that the students make and concepts that they struggle to understand. The study by Makgakga (2016) further outlined that it is important for instructors to analyse the errors and diagnose the exact challenges that the students struggle with. Error analysis should be one of the first steps to take when working to develop algebraic reasoning in students.

It is important for instructors to make use of the different cases of row-reduced matrices that gives unique solutions, no solution, and many solutions when applying Gaussian Elimination. The students should also be able to generate examples of matrices that gives many solutions, unique solutions and no solutions.

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Appendicies

Questions on the activity sheet

Gaussian elimination interview schedule

1. What is the other name for Gaussian elimination?
2. State the three Gaussian elimination rules for the row operations
3. What is the difference between a consistent and inconsistent system of equations?
4. Explain the circumstances that give rise to
 - Unique solution
 - Infinitely many solution
 - No solution
5. Determine whether the systems of linear equations given below is **consistent** or **inconsistent**. Determine whether the solution is **unique** or **infinitely many**, or **no solution**, **justifying your answer**. DO NOT compute the final values of f , g and h please.

$$\begin{aligned} f + d - 2h &= 0 \\ 2f + 2g - 3h &= 1 \\ 3f + 3g + h &= 7 \end{aligned}$$

ENHANCING PUPILS' MOTIVATION AND ACADEMIC ACHIEVEMENT IN MATHEMATICS USING JIGSAW LEARNING STRATEGY IN ENUGU STATE, NIGERIA

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Abstract

Lack of motivation toward learning mathematics coupled with pupils and students' poor achievement in the subject is fast becoming worrisome to educators and education stakeholders. It is expected that jigsaw instructional technique could ameliorate the situation. Hence, the study investigated the influence of jigsaw-teaching technique on motivation and academic achievement of pupils in mathematics. The study utilized pretest-posttest non-randomized quasi-experimental research design. A sample size of 159 primary five (5) pupils drawn for the study is made up of four (4) intact primary five classes. The Pupils' Motivation Rating Scale (PMRS) and the Pupils' Mathematics Achievement Tests (PMAT) were the instruments used for data collection. Mean and analysis of covariance were used to analyze the data collected, to answer the research questions and test the hypotheses respectively at 0.05 level of significance. The result indicated among others that jigsaw instructional technique significantly enhanced pupils' motivation and improved academic achievement in mathematics. Based on the results, teachers are encouraged to utilize jigsaw instructional technique in mathematics classrooms.

Keywords: Enhancing, Motivation, Academic Achievement, Mathematics, Jigsaw and Strategy.

Introduction

Mathematics is a "conditio sine qua non" in the daily life of every individual and the centre of science. Mathematics seems to be shaping creativity and inventions. Mathematics is a prevalent tool for global communication and cohesion. Providing a bedrock for solid intellectual discipline, sound judgement, critical, creative, and abstract thinking as well as problem-solving skills (The Scientific World, 2018). Khan (2015) stated unequivocally that mathematics is encountered in man's everyday life challenges, and so is able to utilize creative thinking and imaginations to invent new knowledge through experimentations. To this effect, Decker (2018) pointed out that no science could exist without mathematics. Mathematics, therefore, is the lingua franca of science. This implies that for the educational and mental development of the individual and global scientific development, mathematics is an indispensable variable.

Despite the prime position of mathematics in the overall development and growth of the nation, pupils in Nigeria still seem to achieve poorly in the subject culminating to unproductive and inadequate number of scientists in the country. Attesting to this, Ikuejawa (2019) pointed out that the poor performance of pupils in First School Leaving Certificate (FSLC) mathematics examinations in the past few years, is an indication of bad days ahead. A pass in mathematics at the FSLC is evidence of successful graduation from primary school in Nigeria. Discouraging performance of pupils in mathematics may be attributed to numerous variables, such as; poor learning styles, learners' attitudes towards mathematics, inappropriate instructional techniques, lack of motivation, lack of qualified teachers among others. Owan (2012) identified quality of teachers, learner's low moral as well as instructional strategy as main predictors of learners' achievement in mathematics. Khan and

Ghosh (2016) stated that unsuitable instructional technique demoralizes and demotivates learners, leading to low achievement on the part of the learners. Learning of mathematics concepts involves the application of some principles and formulas that require appropriate and specialized instructional techniques.

In Nigeria, mathematics lessons are taught using boring teaching and learning strategies which are mostly teacher centered. Ojekwu and Ogunleye (2020) argued that the traditional method (chalk and talk) teaching strategy employed by mathematics teachers does not involve active participation of learners. This type of teaching and learning strategy seems to neither attract nor motivate learners to learn mathematics. This seem to be orchestrated by the lack of the use of appropriate teaching method. Ojekwu and Ogunleye further insisted that even though chalk and talk method of teaching is more convenient for the teachers to employ, it is disadvantageous to the learners, and hampers the learners achievement, and demotivates the learners. For optimum achievement in mathematics, the learners must be motivated to learn the subject.

Motivation is one of the essential factors in teaching-learning processes. A motivated learner finds learning interesting and enjoyable, leading to greater educational success. Khan et al. (2021) stated that motivation is an inward desire that draws an organism towards a goal-oriented activity. Mehndroo and Vandana (2020) described motivation as the inner force that bids a learner to persist and learn a difficult concept with enthusiasm. Motivation, therefore, is understood in this work as an internal drive that arouses the interest and moral of the learner, propelling him/her to learn with positive energy leading to understanding and mastering of difficult concepts and skills. It is obvious that the traditional method of teaching mathematics is inimical to learners' motivation towards mathematics. It is for this reason that Ugwuanyi and Okeke (2020) advocated for a prototype change in the strategy for teaching/learning mathematics and sciences. To this end, there may be the need to employ an engaging and learner centered strategy in teaching mathematics to young children. One of such strategies is jigsaw cooperative instructional strategy.

Jigsaw Instructional Strategy

Jigsaw instructional strategy is one among other cooperative teaching/learning strategies that seem to have great potential and impacts on learners' academic achievement. A group of scholars lead by Elliot Aronson developed jigsaw-teaching strategy in the year 1978. Jigsaw teaching method was developed with the aim of reducing racial discriminations, and nurture cooperation among learners (Ojekwu & Ogunleye 2020). Learners cooperate and teach themselves in jigsaw teaching learning strategy. Jigsaw approach is a social interactive process whereby a learner interacts spontaneously and profoundly with co-learners to learn and succeed. Hence, Areelu and Ladele (2018) conjectured Jigsaw teaching-learning method as an interactive session, in which learners interact mutually among themselves to gain adequate skills needed for academic progress. This method is learner-centered and inspires enormous and deep communicative interaction among learners in a scaffolding manner.

The Jigsaw approach is modeled in line with Jigsaw riddle. Hamadneh (2017) pointed out that jigsaw teaching-learning technique is fashioned to have two groups namely the home group and the expert groups. In jigsaw teaching/learning technique, the class is split into smaller groups of about 4 to 6 learners in each. These groups are referred to as the "home groups". It is preferable to have equal numbers of learners in the groups. At this stage, the concept to be taught is broken down into different sub-headings and distributed among the home group members, each member with a different subheading. A different topic is allotted to each home group member. The "home groups" splits, breaking apart like in the Jigsaw riddle to form "expert groups". The expert group comprised learners from different home groups that are assigned the same themes. In the expert group, the theme is discussed in detail, since the group members have the same theme, with each learner gathering as much

mastery and knowledge as possible. At the expiration of the time marked out for the expert groups to work, each learner returns to his/her home group. Back at the home group each learner is accorded the opportunity to teach other learners (his/her peers) the theme he/she studied in the expert group. By so doing the learners teach and learn from each other. At the end of the lesson period, a test is administered to the learners. Al-Zuhairi, (2013) pointed out that this process culminates in inter-dependency creating a situation whereby learners trust and rely on one another for motivation and improved academic achievement. On this note, the researchers were inspired to investigate the effect of jigsaw instructional strategy on motivation and pupils' academic achievement in mathematics.

On the need to investigate the relationship between jigsaw instructional strategy and learners' motivation, Sitohang et al. (2017) carried out a study titled, "students' motivation in using jigsaw strategy on civics education on class vii students of SMP TD Paradede Foundation Sunggal" in 2016/2017, Medan, Indonesia. The study revealed that the learners taught civic education using jigsaw instruction method were better motivated to learn than their peers who were taught using chalk and talk method. In a related but separate study that investigated the effect of jigsaw method and motivation on students' learning outcomes, Yunita et al. (2020) found out that jigsaw instructional strategy had a significant positive effect on students' learning motivation when compared to lecture method of teaching. In another related study, Omokorede et al. (2021) found out that jigsaw-teaching method significantly aroused and motivated physics students towards the learning of physics.

In another study that investigated the effects of jigsaw teaching strategy on the academic performance of science students in Nigeria, Ojekwu and Ogunleye (2020) found out that jigsaw teaching strategy had a significant positive effect on the academic achievement of science students compared to outcomes after the talk and chalk method is utilized. In a related but distinct study, Yemi et al. (2018) reported that jigsaw approach is a better option in improving academic success in mathematics among secondary school students than the lecture method. In a separate but related study that investigated the means of improving mathematics achievement of low learning ability students in Lagos State, Nigeria, Olawunmu and Alex (2019) found that jigsaw cooperative teaching-learning technique is more efficient and effective than any other teaching-learning method available in the state. Furthermore, Nduji et al. (2020) investigated the impact of jigsaw-teaching technique on senior secondary school students' interest and achievement in physics and the findings indicated that jigsaw was more successful in improving interest and achievement among physics learners in secondary school than lecture method. In all these, it seems that little or no study of this nature has been done with learners at the level of primary school. Hence, the need to investigate the effect of jigsaw instructional technique on motivation and academic achievement of pupils in mathematics. Specifically, the study sought to find out:

1. The effect of jigsaw instructional technique on pupils' learning motivation towards mathematics.
2. The effect of jigsaw instructional technique on pupils' academic achievement in mathematics

Research Questions

1. What is the mean motivation scores of pupils taught mathematics using jigsaw instructional method and those taught mathematics using traditional method?
2. What is the mean scores of pupils' taught mathematics using jigsaw instructional method and those taught mathematics using traditional method?

Hypotheses

These hypotheses were tested at 0.05 level of significance.

1. There is no significant difference in the motivation scores of pupils taught mathematics using Jigsaw instructional method and those taught using talk and chalk method.
2. There is no significant difference in the mean scores of pupils' taught mathematics using jigsaw instructional method and those taught using talk and chalk method.

Methods

The pretest-posttest control group quasi-experimental research design was utilized in the study. The population of the study involved all the 27,058 primary five (5) pupils in Enugu state. The sample size of the study included 159 pupils drawn through purposive sampling technique from Enugu East Local Government Education Authority and Nsukka local government Education Authority respectively. Four (4) intact classes were purposefully drawn from the two education authorities (one control and one experimental group from each education authority, making it two control and two experimental groups). This was done so as not to disrupt the pupils' academic programme since the experiment was carried out during school period following the school calendar. The control group was made up of 81 pupils while the experimental group consisted of 78 pupils. The experimental groups were taught mathematics using jigsaw teaching-learning technique while the control groups were taught using talk and chalk method. For the purpose of data collection, the researchers developed two sets of instruments: Pupils' Motivation Scale (PMS) and Mathematics Achievement Test (MAT). The PMS is a 20-item instrument with four-point Linkert scale of Strongly Agree (4 points), Agree (3 points), Disagree (2 points) and Strongly Disagree (1 point) while MAT is a 20 multiple choice test items intended to measure the pupils' achievement in mathematics. Each question carries 2-marks making a maximum of 40 marks. The face validation of the instruments was carried out by three experts, one each in the areas of childhood education, educational psychology and measurement and evaluation. The internal consistency reliability indices of the instruments were estimated to be 0.87 and 0.83 for PMS and MAT respectively using Cronbach Alpha method.

Before the commencement of the intervention, a pretest of the PMS and the MAT were administered to the sampled pupils to serve as the baseline data. Afterwards, the experimental classes were taught mathematics using jigsaw teaching/learning technique while the control group classes were taught using talk and chalk method. The process lasted 6 weeks. At the commencement of each mathematics lesson, the experimental groups were split into groups of six (6) pupils, labelled the home group. Each pupil in the home group was allocated a theme from the topic for the day, each differing from the other. Those assigned similar themes from each home group came together to form another group labelled expert group. The pupils in the expert group discussed their assigned theme in detail. At the end of the agreed time, the expert group members separated with each pupil returning to his/her home group. Back in the home group, each pupil takes turn to teach his/her peers. At the end of the sixth week, both the MAT and the PMS were reshuffled and administered as post-tests to the participants. Mean and standard deviation were used to analyze the data collected in order to answer the research questions while independent samples t-test was utilized to test the hypotheses at 0.05 level of significance.

Results

Table 1

Mean analysis of motivation scores of the pupils based on treatment

| Treatment | n | Pretest | | Posttest | | Mean gain |
|--------------|----|---------|-------|----------|------|-----------|
| | | Mean | SD | Mean | SD | |
| Experimental | 78 | 37.43 | 11.92 | 71.05 | 4.78 | 33.62 |

| | | | | | | |
|---------|----|-------|-------|-------|------|------|
| Control | 81 | 37.69 | 12.23 | 43.88 | 8.80 | 6.19 |
|---------|----|-------|-------|-------|------|------|

Table 1 shows that the pupils taught mathematics using Jigsaw instructional strategy had a post-test mean motivation score ($M = 71.05$, $SD = 4.78$) with a mean gain score of 33.62 while those taught using the conventional lecture method had a post-test mean motivation score ($M = 43.88$, $SD = 8.80$) with a mean gain score of 6.19. This indicates that pupils taught mathematics using Jigsaw instructional strategy had higher post-test mean motivation score than their counterparts did.

Table 2

Analysis of covariance for the effect of treatment on pupils' motivation in mathematics

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|-----|-------------|---------|------|---------------------|
| Corrected Model | 29349.927 ^a | 2 | 14674.963 | 288.731 | .000 | .787 |
| Intercept | 46280.190 | 1 | 46280.190 | 910.567 | .000 | .854 |
| Pre-motivation | 32.992 | 1 | 32.992 | .649 | .422 | .004 |
| Treatment | 29334.543 | 1 | 29334.543 | 577.160 | .000 | .787 |
| Error | 7928.803 | 156 | 50.826 | | | |
| Total | 557753.000 | 159 | | | | |
| Corrected Total | 37278.730 | 158 | | | | |

a. R Squared = .787 (Adjusted R Squared = .785)

Table 4 revealed that there is a significant difference in the motivation scores of pupils taught mathematics using Jigsaw instructional method and those taught using talk and chalk method in favour of those taught using Jigsaw, $F(1, 156) = 577.160$, $p = .000$. Moreover, the effect size of .787 indicates that 78.7% change in the posttest motivation scores of the pupils is attributed to the effect of Jigsaw instructional strategy.

Table 3

Mean analysis of mathematics achievement scores of the pupils based on treatment

| Treatment | n | Pretest | | Posttest | | Mean gain |
|--------------|----|---------|------|----------|------|-----------|
| | | Mean | SD | Mean | SD | |
| Experimental | 78 | 10.19 | 2.34 | 34.82 | 2.31 | 24.63 |
| Control | 81 | 10.14 | 2.31 | 15.98 | 5.50 | 5.84 |

Table 3 shows that the pupils taught mathematics using Jigsaw instructional strategy had a post-test mean achievement score ($M = 34.82$, $SD = 2.32$) with a mean gain score of 24.63 while those taught using the conventional lecture method had a post-test mean achievement score ($M = 15.98$, $SD = 5.50$) with a mean gain score of 5.84. This indicates that pupils taught mathematics using Jigsaw instructional strategy had higher post-test mean achievement score than their counterparts.

Table 4

Analysis of covariance for the effect of treatment on pupils' achievement in mathematics

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|----|-------------|---------|------|---------------------|
| Corrected Model | 14111.418 ^a | 2 | 7055.709 | 389.980 | .000 | .833 |
| Intercept | 5674.045 | 1 | 5674.045 | 313.613 | .000 | .668 |
| Pre-test | 18.044 | 1 | 18.044 | .997 | .320 | .006 |

| | | | | | | |
|-----------------|------------|-----|-----------|---------|------|------|
| Treatment | 14101.702 | 1 | 14101.702 | 779.422 | .000 | .833 |
| Error | 2822.431 | 156 | 18.093 | | | |
| Total | 118117.000 | 159 | | | | |
| Corrected Total | 16933.849 | 158 | | | | |

a. R Squared = .833 (Adjusted R Squared = .831)

Table 4 revealed that there is a significant difference in the achievement scores of pupils taught mathematics using Jigsaw instructional method and those taught using talk and chalk method in favour of those taught using Jigsaw, $F(1, 156) = 779.422, p = .000$. Moreover, the effect size of .833 indicates that 83.3% change in the posttest achievement scores of the pupils is attributed to the effect of Jigsaw instructional strategy.

Discussion

The findings of the study revealed that pupils taught mathematics using jigsaw instructional technique had a higher motivation score than those instructed utilizing lecture method. Furthermore, the result showed that there existed a significant difference in the mean motivation score of pupils taught with jigsaw technique and those taught using lecture style. The implication of this is that jigsaw instructional strategy has a positive effect on motivation. These findings are in line with the findings of Sitohang et al. (2017) and Yunita et al. (2020) who found that Jigsaw method of instruction motivates learners and increases students' interest to learn and participate actively in school activities. Furthermore, the findings of the study validated the findings of Omokorede et al. (2021) found out that jigsaw-teaching method significantly aroused and motivated physics students towards the learning of physics.

Also, the outcome of the study indicated that the pupils who were instructed using jigsaw method of instruction had a higher post-test achievement mean score than their counterparts who were instructed with lecture method. The study also showed that there is a significant difference in the achievement mean score of pupils taught mathematics using jigsaw technique and those taught using lecture method in favour of those taught using jigsaw instructional strategy. These findings are in line with the findings of Ojekwu and Ogunleye (2020) who found out that jigsaw teaching strategy had a significant positive effect on the academic achievement of science students. Furthermore, the result of the study corroborated the findings of Yemi et al. (2018) who found out jigsaw approach is a better option in improving academic success in mathematics among secondary school learners. Again, the study confirmed the findings of Olawunmu and Alex (2019) who found out that jigsaw cooperative teaching-learning technique is more efficient and effective than any other teaching-learning method available in the Lagos state, Nigeria. The study also validated the findings of Nduji et al. (2020) who established that jigsaw was more successful in improving interest and achievement among physics learners in secondary school than lecture method.

Conclusion

In conclusion, therefore, it is evident from the outcomes of the study that jigsaw method of instruction has a positive effect on pupils' motivation in learning mathematics. This is because jigsaw-teaching techniques make it possible for children to learn from their peers and through play. Again, jigsaw-teaching technique enhances children's academic achievement in mathematics. This is because the strategy motivates them to love the subject thereby instigating the pupils to be active during teaching and learning of mathematics.

Recommendations

Based on the outcomes of the study, the following recommendations were proffered:

1. That primary school mathematics teachers should endeavour to employ jigsaw instructional techniques in the classrooms.
2. That Local Government Education Authorities should organize workshops and training for primary school teachers on the use of jigsaw instructional strategy.
3. Future researchers should try this intervention in other school subjects.

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PARENTAL INFLUENCE AND TEACHING RESOURCES AS PREDICTORS OF PUPILS' PERFORMANCE IN MATHEMATICS IN IGBO-ETITI LOCAL GOVERNMENT EDUCATION AUTHORITY, ENUGU, NIGERIA

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Abstract

This study examined the relationship that existed between parental support and teaching resources. The study adopted correlational research design. The population of the study comprised all the 52 headteachers, 472 classroom teachers, as well as 1, 822 registered members of the School Based Management Committee (SBMC) in the 52 public primary schools in Igbo-Etiti Local Government Education Authority (IELGEA) in Enugu, Nigeria. The sampled 208 respondents were drawn through purposive sampling. The instruments for data collection included a researcher-made questionnaire and pupils' academic achievement proforma. The questionnaire was validated, and pilot tested and an internal consistency reliability index of .86 was gotten by means of Cronbach alpha method. Data were analyzed using simple linear regression analysis. The discoveries of the study revealed among others that there is a significant relationship between parental support and pupils' academic achievement in Mathematics and that there is a positive affiliation between teaching resources and pupils' academic achievement in mathematics. These findings have implications for pupils' education career since Nigerian universities do not admit a student without a credit in mathematics

Keywords: Parental Influence, Teaching Resources, Predictors, mathematics achievement

Introduction

Formal education is an interesting and indispensable aspect of human endeavour. Education is the tool for individual and national development. According to Wanyonyi (2013), education is a fundamental instrument for development and positive change in behaviour of an individual and that of the community at large. Every parent in Nigeria wishes that his/her child performs well in school subjects, especially the core subjects of which mathematics is one. According to Yamamoto and Holloway (2010), parents desire the best performance for their children at school. But focusing on mathematics, Marta, Emily and Beatriz (2003) noted that improved academic performance in mathematics is the dream of all parents for their children.

Mathematics is one of the subjects taught in Nigerian schools. Considering the importance of Mathematics, the Federal government of Nigeria is considering teaching the subject in indigenous languages for better understanding and grasp of the subject (Onu, 2020). This is because the Federal Government of Nigeria has made mathematics a compulsory and core subject in both primary and secondary schools in Nigeria (FRN, 2004). The public thinks of mathematics as consisting of manipulations and computations of numbers. According to Ngesu and Simotwo (2018), the idea of mathematics as computation and manipulation of numbers is an incomplete idea of mathematics since computations and management of numbers are only part of the discipline. Wile (2017) maintains that mathematics teaches logic, critical and analytical thinking that led to discoveries and inventions. Children need to be grounded in the knowledge of mathematics since it has practical applications in real life and in other subjects. Mathematics is evident in every

human activity, the foundation block for our mobile devices, engineering activities, architecture, sports, economics, arts among others is mathematics (Elaine, 2013). On this note, Ngesu and Simotwo maintain that adequate understanding and grasp of mathematical know-how remains an indispensable condition for academicians at all stages and levels of education. This means that operative applications of mathematical principles and skills assure a nation of productive human resources in the future. In spite of the fact the mathematics is one of the subjects that is taught and learned from primary school through secondary school into some lucrative courses in the universities such as medicine and engineering in Nigeria, pupils still register unsatisfying results in mathematics, the location of the school notwithstanding.

The Federal Republic of Nigeria ([FRN], 2013) structured the Nigerian education system into three tiers through the instrumentality of National Policy on Education (NPE), namely, the Basic Education level (0 -15 years); the Post Basic Education level and the Tertiary Educational level. Of these three levels of education in Nigeria, this work is interested in the Basic Education level, precisely, the Primary Education level which is education given to children aged 6 – 12 years. Primary education refers to educational instruction designed for and given to youngsters between 6 and 12 years plus. FRN (2004), concluded that primary education is an education given to children aged 6 to 12 years plus in an educational institution. The FRN posits that the primary level of education is crucial to the success or failure of the whole system of education since the rest of the education system is built upon it. It is based on the critical role of primary education on individual and national development to produce children who are strong, worthy, and adequate in character and learning (Ncheke, 2016), which lead to the introduction of various educational programmes by the federal government of Nigeria. For instance, Imogie (2014) stated that the Federal Military Government led by Gen. Olusegun Obasanjo launched Universal Primary Education (UPE) programme in 1976 to address the falling standards of education in the primary schools, though it was a failed project. Again, in 1979 a civilian government led by the same Obasanjo came up with another programme; Universal Basic Education (UBE). These were all attempts to revamp primary education so, as to achieve the goals and objectives of primary education.

Primary education places a major emphasis on teaching children the basic skills of reading, writing, language, and mathematics. The arts, languages other than English, social education programmes, health, and physical recreation also play crucial roles in primary education programmes (FRN, 2004). According to Education and Training Directorate (2015), close contact is maintained between high schools and primary schools so that learners make a smooth academic, personal, and social transition between the sectors. At the primary school level, the schools are regulated, and controlled by the Universal Basic Education Commission established in each state of the federation (Yama & Izom, 2018).

The primary school programme is designed to help the children become useful members of the community in the future. According to Obiweluzor (2014), primary school education contributes significantly to the eradication of illiteracy, which seems to be one of the strongest indicators of poverty. This implies that primary school education may also help to eradicate child abuse. In order to achieve this among other objectives of Universal Basic Education, primary school education shall be compulsory, free, universal and qualitative for every Nigerian child (FRN, 2004). The FRN further stated that primary school children are to be aged between 6-12 years. Primary Education is, therefore, an education given to children in preparation for entrance into the secondary schools.

A child's academic achievement is essential, as it is a necessary indicator for a successful life and improved economy. Jamil and Khalid (2016) maintained that academic achievement is an inevitable factor in the future success of the child and that family

dysfunction may hamper the academic achievement of primary school children. Richard et al. (2017) viewed academic achievement as performance outcomes that signify the level of success an individual has attained in some specific cognitive activities after instructions in an educational setting. According to Dzulfli and Alias (2012), academic achievement is generally categorized into two levels; high and low academic achievements. Parental influence may significantly affect the pupils' achievement in school subjects, especially in mathematics. According to Yamamoto and Holloway (2010), parents desire to influence and inspire their children for optimum performance and achievement in their school programme.

Parental influence refers to any role by the parent that impacts or shapes the behaviour of the child. Parental influence refers to attitudes, views, and activities of parents that control and model the behaviour of the child (Nebor, 1986). Parents create the environment in which the child grows and learns. According to eNotes Editorial (2011), parents are expected to create enabling environments to aid the child and exact influence the child's intelligence and personality by the quality of their interaction with the child. Quality interaction and support seem to be aspects of parental influence that are indispensable in the academic performance of children in mathematics. Quality interaction and academic support in a conducive family environment bring about enhanced performance in mathematics (Linda, Lisa, Channa, Brigid & David, 2019). Therefore, it seems justified to say that parents' support plays a significant role in the academic performance of pupils in mathematics.

Parental support is all measures and strategies put in place by the parent for the sustenance of the child. Ajila and Olutola (2001) maintained that parents' support refers to the aggregation of the commitment provided by parents to the child be it material, moral, educational among others. Some authors such as Ruholt et al. (2015) viewed parents' support as premeditated actions of the parents that play substantial roles in the overall development and progress of the child. Hence, parents' support seem to impact momentarily on the academic performance of the child. In this study, parents' support was limited to educational support parents offer the child that may lead to a better performance in mathematics. This includes the provision of education and teaching resources.

Teaching resources refer to any maneuver, item, or mechanism used by the teacher in the course of instruction to learners. According to the Ministry of Education, Guyana (2016), teaching resources refer to all the tangible and intangible materials and properties employed by teachers in the course of delivering instructions to assist learners to understand the subject being taught. Teaching resources involve human and material properties. Study.com (2016) viewed teaching resources as involving all channels through which learners gain knowledge. Teaching resources, therefore, refer to human and intelligible sources through which pupils gain knowledge of mathematics.

It seems that the majority of Nigerian children dread Mathematics. They consider it abstract, complex and difficult. Many schoolchildren do not perceive the immediate use of Mathematics or its application to their daily lives and in the society and so, do not understand why they should be troubled with the study of such an abstract subject (Ngesu & Simotwo, 2018). In Nigeria, Mathematics happens to be one of the core subjects taught in primary and post-primary schools (Jega & Julius, 2018). To this end, a minimum of credit pass in Mathematics is a compulsory requirement for admission into Nigerian Universities, yet one observes an abysmal and dismal performance and achievement of pupils in the subject.

In a study that explored the association between parental support and learners' success in mathematics in high schools, Tombari and Danner (2012) discovered that parental support has a positive relationship with the learner's achievement in mathematics. In a related study, Qudsyi (2013) found out that parents' support has significant and positive relationship with students' mathematics ability in elementary schools. Again, in a similar but distinct study, Lara and Saracostti (2019) hypothesized that students who enjoy adequate support from

parents are more confident and achieve more in school than others who do not. In another but related study, Shahzad et al. (2020) discovered that learners who enjoy high parental involvement and support exhibit high self-esteem and achieve better in school than others.

In another study that examined the relationship between students' performance in mathematics and teaching-learning aids in Pallis district high schools, Nduga (2019) discovered that teaching resources alone has no significant effect on students' achievement in mathematics. In a similar but distinct study Yara and Omondi (2010) discovered that teaching-learning resources enhance the academic of secondary school learners. In a separate study that x-rayed the effect of teaching resources on students' academic achievement, Edoho et al. (2020) stated that resources materials in teaching-learning process have significant and positive association with students' success and interest in all school subjects. However, Ndlovu (2018) in an empirical study showed that school resources enhanced the academic achievement of primary school children.

In the recent past, the issues poor performance and enhancing pupils' achievement in mathematics have posed some puzzles to educators and researcher. Researchers have made relentless efforts to identify factors that bring about pupils' poor performance and achievement in mathematics with a view to improving the situation. Despite efforts by teachers and educators to make mathematics lovable and interesting to children, there is still observable hatred and poor achievement of pupils in mathematics. This is so, even though the role of mathematics is obvious in the daily life of the children and their further education. Several research works have suggested factors within and outside the school environment that militate against pupils' performance and interest in mathematics. These factors seem to have a preponderance in Igbo-Etiti Local Government Education Authority. Other factors identified include but not limited to parental influence, teaching resources and teachers' educational qualifications. Despite concerns and commitment shown by stakeholders and policymakers, pupils continue to exhibit abysmal and unfortunate performance in mathematics in the said Local Government Education Authority. The study, therefore, pursued answers to the ensuing questions:

- (1) What is the predictive power of parental support on pupils' achievement in mathematics?
- (2) What is the predictive power of teaching resources on pupils' achievement in mathematics?

Hypotheses

Ho₁: Parental support has no significant predictive power on pupils' achievement in mathematics.

Ho₂: Teaching resources have no significant predictive power on pupils' achievement in mathematics.

Methods

Correlational survey research design was adopted for the study. According to Formplus Blog (2020), correlational research design is a type of research design that enables the researcher to observe two or more variables in order to determine adequately the statistically corresponding relationships between them without manipulating the variables. This study examined the relationship between parental support, teaching resources and pupils' academic achievement in mathematics in IELGEA. This design has been used by Achagh et al. (2020), Eya et al. (2020), Ezema et al. (2019), Gana et al. (2019), Okenyi et al. (2021) Ugwuanyi and Okeke (2020), Ugwuanyi et al. (2020a, b, c) in similar studies.

The population of the study comprised of the 52 headteachers and 472 classroom teachers in the 52 public primary schools as well as 1,822 registered members of the School Based Management Committee (SBMC) in IELGEA. The sample size of the study was 208

respondents drawn through purposive sampling technique. Thus; 52 headteachers, 52 teachers and 104 parents (1 head teacher, 1 teacher, and 2 parents from each of the 52 public primary schools). The instruments for data collection were the researcher made structured questionnaire on parental support and teaching resources titled Parental Support and Teaching Resources Questionnaire (PSATRQ) with a 4-point Likert scale, and Pupils' Academic Achievement Proforma. The face validity of the instruments was assessed by giving the instruments to some experts in the fields of Childhood Education, Educational Psychology, and Measurement and Evaluation Units, of the Faculty of Education, University of Nigeria, Nsukka. The structured instrument was made of 12 items grouped into 2 clusters. Cluster A (6) items was on parental support, and cluster B (6) items were on teaching resources. The items were structured on a 4-point Likert scale of Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1). The reliability of the instrument was ascertained using Cronbach alpha method, which yielded an index of .75 and .78 for clusters A and B respectively and an overall index of 0.86, indicating that the instrument is adequate for the study. Data collected were analyzed using simple linear regression analysis to answer the research questions and test the null hypotheses at 0.05 level of significance.

Results

Table 1

Regression analysis of the predictive power of parental support on pupils' achievement in mathematics

| Model | R | R Square | T | Sig |
|-------|-------------------|----------|-------|------|
| 1 | .415 ^a | .172 | 6.541 | .000 |

a. Predictors: (Constant), Parental Influence

Table 1 shows that the magnitude of the association between parental support and pupils' achievement in mathematics is .415 with a coefficient of determination of .172. Thus, there is a positive relationship between parental support and pupils' achievement in mathematics. Besides, the coefficient of determination of .172 implies that 17.2% change in the achievement of pupils in mathematics is attributed to their parental support. Besides, parental support had a significant predictive power on pupils' achievement in mathematics, $t(208) = 6.541, p = .000$.

Table 2

Regression analysis of the predictive power of teaching resources on pupils' achievement in Mathematics

| Model | R | R Square | T | Sig |
|-------|-------------------|----------|-------|------|
| 1 | .420 ^a | .176 | 6.635 | .000 |

a. Predictors: (Constant), Teaching Resources

Table 2 shows that the magnitude of the association between teaching resources and pupils' achievement in mathematics is .420 with a coefficient of determination of .176. Thus, there is a positive relationship between teaching resources and pupils' achievement in mathematics. Hence, the coefficient of determination of .176 implies that 17.6% change in the achievement of pupils in mathematics is attributed to teaching resources. Besides, parental support had a significant predictive power on pupils' achievement in mathematics, $t(208) = 6.541, p = .000$.

Discussion of Findings

Addressing the interchange between parental support and pupils' academic achievement in mathematics, Table 1 shows that there is a positive and significant relationship between parents' support and pupils' achievement in mathematics. The result of this study validated the findings of Tambari and Danner (2012) who discovered that parents' support to high school students significantly improved the learners' achievement in mathematics. The findings of the study went further to validate the finding of Qudsyi (2013) who found out that the parent's support has a positive effect on students' achievement in mathematics in secondary school level. Furthermore, the outcomes of the study confirmed the findings of Lara and Saracostti (2019) and Shahzad et al. (2020) who theorized that learners who enjoy high parental involvement and support exhibit high self-esteem and achieve better in school than their peers.

In the case of the association between teaching resources and pupils' achievement in mathematics, the study found out teaching resources had a significant positive relationship with pupils' achievement in mathematics. This finding is in line with the findings of Edoho et al. (2020) who discovered that the support secondary school learners receive from parents enhances the learners' achievement in all school subjects, mathematics inclusive. Again, the outcomes of the study confirmed the discoveries of Ndlovu (2018) and Yara & Omondi (2010) who postulated that resources materials in teaching-learning process has significant and positive association with students' success and interest in all school subjects. However, the result of the study contradicted the findings of Nduga (2019) who revealed that teaching resources alone has no significant effect on students achievement in mathematics.

Conclusion

From the discoveries of the study, parental support and teaching resources are essential variable in the education of the child. Both complement themselves to influence the child's achievement in mathematics positively while making learning mathematics fun and easy for the pupils. The child's success in mathematics has enormous implications in his life and career in education since all other school subjects has elements of mathematics in them.

Recommendations

Based on the findings of the study the researchers recommend that:

1. Parents should be encouraged to provide a solid education support to their children.
2. It will benefit students if adequate teaching resources would be made available to schools, and if teachers are encouraged to utilize these teaching resources.

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ASSOCIATION BETWEEN TASK PERSISTENCE AND SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN PHYSICS

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Abstract

The study explored the association between students' task persistence and their physics academic achievement. The research was conducted in Nigeria's Enugu State's Nsukka Education Zone. A correlational survey methodology was used in this investigation. A sample of 271 senior secondary SS II physics students in Nsukka Education Zone, Enugu State was used for the study. The data were collected using Physics Achievement Test (PAT) and the Task persistence Inventory (TPI). The PAT's reliability index was calculated using the Kuder-Richardson formula 20 (KR-20), which provided a coefficient of 0.723. The Cronbach Alpha technique was used to calculate the TPI dependability index of 0.896. Data were analyzed using regression analysis. The study's findings revealed that there is a positive and significant association between task persistence and students' physics achievement and that location has no significant moderating influence on the relationship between task persistence and students' physics achievement. It was suggested that Physics teachers foster in their students the belief that work leads to achievement, among other things.

Keywords: Task persistence, Physics, Academic achievement, School location

Introduction

Physics is a discipline of science that studies the properties of matter and energy, as well as their interactions (Michael, 2006). It is a branch of research concerned with the universe's fundamental ingredients, the forces they exert on one another, and the outcomes of these forces (Ayansina, 2016). Physics is used in practically every human activity, as it is a part of almost every career (Awotua-Efebo et al., 2015). Physics, as a foundational science topic, has countless applications and is the backbone of science and technology development in any country. Its significance has pervaded every facet of human existence in the universe. Physics is the cornerstone of industrialization (Atadoga, 2010). Developing countries such as Nigeria must embrace science and technology as critical instruments for advancing their socioeconomic growth. Physics' importance has made it necessary for it to be included in the Nigerian senior high school science curriculum (Federal Republic of Nigeria, 2014). Physics is an important subject to study in secondary school since it provides students with the fundamental knowledge and understanding of ideas whose application greatly improves society's quality of life. Physics teaches students how to use the ideas they've learned, as well as their knowledge and talents, to build appropriate scientific devices out of readily available materials (Arseneault, 2014).

Despite the importance of physics and its application in almost every aspect of human endeavour, secondary school pupils' performance in the subject has room for improvement. Some experts have expressed concern about pupils' low performance in science classes, particularly in physics. According to Ajaja (2013), poor performance in science topics in secondary schools has been a major source of concern for educators, businesses, and the government at large. According to Oniyangi (2013), pupils' academic performance in science areas, particularly physics, has not been encouraging. Students consider physics a challenging

topic because of its seeming abstract nature (Sintayehu, 2014). Given the importance of physics in technological advancement, effective teaching and learning should be taken seriously. Students who may want to pursue physics at a higher level of education have tended to drop out due to low performance (Mabula, 2012).

Many researchers have attempted to improve students' academic achievement in physics by providing better teaching methods and materials (Buabeng et al., 2014), using cooperative teaching methods (Christian & Pepple, 2012), using computer simulations in physics teaching (Ilorah & Adeniji, 2018), and concept mapping (Wanbugu et al., 2013). Because achievement is so crucial in human life and activities, it is important to evaluate other elements that impede students' achievement in addition to the teachers' instructional methods. This is because, although multiple academics have looked into the effects of various instructional approaches, the problem of students' poor physics achievement persists. As a result, there is a need to look at physics students' psychological characteristics including task persistence.

Task persistence is a form of behaviour that students display when they are completing learning activities (DiCerbo, 2016). Task persistence, as a component of learning behaviour, is a key factor in student's ability to learn and acquire academic skills. Students who remain focused even when tasks get difficult are more likely to develop new skills that will help them persevere in confronting and mastering new tasks. A student who has better starting skills is less likely to become dissatisfied and, as a result, is less likely to give up trying, boosting the chances of academic advancement. Task perseverance is a favourable predictor of academic accomplishment, according to Hart (2012). Stekel and Tobias (2013) discovered a link between self-perceptions of tenacity and achievement. Task perseverance has a strong association with pupils' academic progress, according to Haugen (2015). Task persistence refers to a student's ability to continue learning until he or she achieves his or her educational goal. This means it could be subject- or even content-specific.

According to Okonkwo (2012), school locations are divided into urban and rural areas. Because of the psycho-social impact on teachers and students, the urban-rural divide may have an impact on students' progress in physics, just as it does in other subjects (Okonkwo, 2012). As a result, the learning environment has been discovered to be a powerful predictor of student achievement (Nworgu et al., 2013). They may even determine a student's academic success in science. According to studies by Nworgu et al. (2013), students in rural areas have lower educational aspirations than their urban counterparts. According to Elloit and McGregor (2011), the location of the educational setting is a factor that influences learning. Urban pupils outperform their rural counterparts in science, according to Yusuf (2010), Ezeudu and Obi (2013), Nworgu et al. (2013), and Ugwuanyi (2015). However, according to Ezeudu (2003), students in rural and urban settings performed similarly.

According to Hudacs (2017), the type of rural community has little bearing on college students' task persistence. Dum Dumaya and Rodrigo (2018) discovered that task persistence differed significantly depending on geographical variation. According to several findings on school location and task persistence, pupils' locational influence differs. While some argue that urban students perform better in exams than rural kids, others have discovered that rural students perform better. Some researchers have concluded that no one setting (urban or rural) can claim superiority over the other because their results are comparable. The researchers seek to determine the relationship between task persistence and academic achievement in senior secondary school physics irrespective of their school location with particular reference to Nsukka Education Zone of Enugu State.

Statement of Problem

Despite a desire for technical advancement and the fact that physics is a critical topic for technological advancement, students' poor academic performance in the subject has been a source of concern for all stakeholders. There is generally low performance in physics in Nigeria coupled with a lack of interest and motivation to pursue it as a degree in a higher education institution. This reduces the number of students interested in continuing their studies in physics at a higher level. Teaching and learning must take into account students' personality qualities such as task persistence to achieve high rankings and quality outputs measured in terms of the quality of students generated. Thus, the research question is: What are the correlations between task persistence and students' academic achievement in physics when school location is used as a moderating variable?

Purpose of the Study

The overall goal of this research is to determine the links between task perseverance and students' physics achievement in senior secondary school. The study's goal is to see if there is a correlation between task persistence and academic achievement among students in senior secondary school physics, and whether location moderates this relationship.

The specific research questions which guided the study is:

1. What is the association between task persistence and academic achievement among senior secondary school physics students?
2. What is the relationship between task persistence and physics achievement among senior secondary school students moderated by school location?

The following null hypotheses were tested:

1. There is no significant association between task perseverance and academic achievement of students in senior secondary school physics.
2. The relationship between task persistence and academic achievement of senior secondary school physics students is not moderated by school persistence.

Methods

A correlational survey design was used in this investigation. The research was carried out at Enugu State's Nsukka Education Zone. This design has been used by Achagh et al. (2020), Eya et al. (2020), Ugwuanyi, Okeke and Njeze (2020), Ugwuanyi, Okeke and Ageda (2020), in similar studies. The population of this study consisted of 2079 senior secondary two (SSII) physics students from urban and rural secondary schools in Nsukka Education Zone, Enugu State (976 urban physics students and 1,103 rural physics students). The sample of the study included 271 senior secondary two (SSII) physics students (147 urban physics students and 124 rural physics students). A multi-stage sampling approach was used to collect the samples.

Instruments for Data Collection

The data were collected using two instruments: Physics Achievement Test (PAT) with 30 physics objective multiple choice questions with four options (A, B, C, D), and the Task persistence Inventory (TPI) with 20 items of a 4-point scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instruments were validated by three experts from University of Nigeria, Nsukka, one from measurement and evaluation unit, one from physics education unit and one from psychology of education unit. The instruments were trial tested by twenty SSII physics students from community secondary school Obollor-Afor, in Obollor-Afor Education Zone. The Kuder-Richardson formula 20 (KR-20) was used

to calculate the PAT's reliability index, which returned 0.723 coefficients. The Cronbach Alpha technique was used to calculate the TPI reliability index of 0.896.

The data were evaluated with the use of linear regression analysis. Research questions 1 and 2 were answered using the simple linear regression results, hypothesis one was tested using the result of the regression analysis of variance while hypothesis two was tested using a t-test of the significance of correlation coefficients. The hypotheses were tested using a 0.05 level of significance t-test of significance between correlation coefficients.

Results

Table 1

Regression analysis of the relationship between task persistence and academic achievement of students in senior secondary school physics

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .447 ^a | .200 | .197 | 10.63871 |

a. Predictors: (Constant), Task Persistence

The correlation coefficient between task persistence and academic achievement of physics students is 0.447, with a coefficient of determination of 0.20, as shown in Table 1. This demonstrates a positive relationship between task persistence and physics students' academic achievement. As a result, the more a student perseveres in completing a task, the higher their academic achievement in physics. The coefficient of determination shows that task persistence accounts for 20% of the variation in physics students' achievement.

Table 2

Analysis of variance of the relationship between task persistence and academic achievement of students in senior secondary school physics

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|-------------|--------|-------------------|
| 1 | Regression | 7613.324 | 1 | 7613.324 | 67.266 | .000 ^b |
| | Residual | 30446.027 | 269 | 113.182 | | |
| | Total | 38059.351 | 270 | | | |

a. Dependent Variable: Achievement

b. Predictors: (Constant), Task Persistence

Table 2 revealed that there is a significant relationship between task persistence and academic achievement of students in senior secondary school physics, $F(1, 269) = 67.266$, $p = .000$. This implies that task persistence is a major determinant of students' achievement in physics. Hence, the null hypothesis was rejected since the probability value of .000 is less than the 0.05 level of significance.

Table 3

Regression analysis of the relationship between task persistence and academic achievement of students in senior secondary school physics as moderated by school location

| Location | N | R | R Square | Adjusted Square | R | Std. Error of the Estimate |
|----------|-----|-------------------|----------|-----------------|---|----------------------------|
| Urban | 147 | .426 ^a | .181 | .175 | | 10.08281 |
| Rural | 124 | .463 ^a | .214 | .208 | | 11.23025 |

Predictors: (Constant), Task Persistence

Table 3 reveals that the relationship between task persistence and academic achievement of urban students is 0.426 with a coefficient of determination of 0.181, whereas the relationship between task persistence and academic achievement of physics students in rural school settings are 0.463 with a coefficient of determination of 0.214. This shows that task persistence and academic achievement have a positive relationship in both urban and rural students. However, task persistence accounts for 18.1 percent of the variation in urban school students' academic achievement and 21.4 percent of the variation in rural school students' academic achievement, according to coefficients of determination of 0.181 and 0.214 for urban and rural school physics students, respectively.

Table 4

t-test analysis of the moderating influence of location on the relationship between task persistence and academic achievement of students in senior secondary school physics

| Location | n | R | df | t | Sig |
|----------|-----|------|-----|--------|------|
| Urban | 147 | .426 | 269 | -0.375 | .707 |
| Rural | 124 | .463 | | | |

Predictors: (Constant), Task Persistence

Table 4 shows that location had no significant moderating effect on the relationship between task persistence and students' physics academic achievement, $t(269) = -0.375$, $p = .707$. This means that the null hypothesis that location had no significant moderating effect on the relationship between task persistence and students' physics academic achievement was not rejected. This is because the p -value of .707 is bigger than the 5% level of significance.

Discussion

Findings revealed that task persistence had a significant relationship with the academic achievement of students in senior secondary school physics. The result is consistent with the normal reality in the sense that when a student persists in doing his or her academic activities, he or she is bound to have increased academic achievement. In other words, the amount of time a student spends on a given task determines his or her achievement in that task. The result of this study is in agreement with the findings of the study conducted by Anderson and Bergman (2011) who studied the role of task persistence in young adolescence for successful educational and occupational attainment in middle adulthood in Swedish. Task perseverance was found to be significantly associated with learners' educational achievement in the study. The inference was that if students can persevere in completing allotted tasks (e.g., exercises) despite obstacles, their academic performance will increase, and vice versa.

Furthermore, there was no significant moderating effect of location on the relationship between task perseverance and students' academic achievement in senior secondary school physics, according to the findings. This means that the association between task perseverance and academic achievement in senior secondary school physics is not location dependent. This means that Work Persistence entails not just a person's initial motivation to complete a task, but also the ability to maintain that motivation despite obstacles that may obstruct task completion. Thus, regardless of their school location, a task persistent student consistently spends effort and seeks various techniques to complete difficult work rather than giving up. The findings of this study align with those of Hudacs (2017), who investigated the likelihood of college-going students from three different types of rural areas successfully transiting into and persisting at Vermont University's four-year residential college. The findings revealed that student variables connected to poverty and academic preparedness have the biggest impact on college students' persistence, while the type of rural community has no significant impact. The current study differs from Dumdumaya and Rodrigo's (2018) study, which

looked at Predicting Task persistence in a Learning-by-Teaching Environment. In terms of location variation, the study found a significant difference in task persistence (Dumdumaya & Rodrigo, 2018).

Conclusion and Implication

Based on the study's findings, the following conclusions were reached: Students' task persistence is a significant determinant of their physics achievement. It was also discovered that the nature of the association between task perseverance and physics achievement in senior secondary school is unaffected by school location. This research will assist physics teachers in implementing psychological processes (task persistence) that will improve students' egos, resulting in an inner sense of satisfaction when they complete academic assignments. It will also assist physics students in demonstrating great confidence in their talents by allowing them to see challenges as chances to control and manage their abilities.

Recommendations

The researchers provided the following recommendations based on the study's findings and educational implications:

- Teachers should encourage students to persevere in their learning assignments so that they can succeed in their physics classes. This will help them attain better results in physics.
- Teachers should develop relationships with their students by supporting an independent work style and assisting students in developing these attributes that will help them succeed academically through persistence in their academic tasks.

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IMPACT OF LACK OF COMPREHENSIVE SEXUALITY EDUCATION ON PSYCHOSOCIAL BEING OF SECONDARY SCHOOL LEARNERS IN LADY FRERE DISTRICT

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Abstract

The aim of the study was to explore the impact of the lack of comprehensive sexuality education on the psychosocial being of learners in secondary schools in Lady Frere, South Africa. The Department of Basic Education faces the challenge of the accumulative number of learners falling pregnant while in school. This is attributed to peer influence, absence of parental supervision, lack of role models, being raped, among other reasons. A qualitative descriptive case study research design was used in the study. A purposive sampling technique was used to identify the 13 participants who participated in the study. Open-ended interviews were used to collect data. Thematic frames and thick descriptions were adopted for data presentation and analysis. One of the key findings was that lack of comprehensive sexuality education in secondary schools had a huge negative effect on learners' psychosocial being. Learners suffer consequences of being young parents because they are not given appropriate, trusted, and adequate knowledge about sexuality education to make informed decisions and protect themselves. The study concludes that school-based sexuality education is effective in improving teenagers' knowledge and understanding of sexual risk behaviour. The paper recommends that information given to adolescents as part of comprehensive sexuality education, be relevant and consider learners' age. It should not be the duty of only Life Orientation educators to teach sexuality matters, particularly because learners and other subject teachers have no regard for Life Orientation.

Keywords: Comprehensive Sexuality Education; Life Orientation; Teenage Pregnancy, Sexual Transmitted Infections

Introduction

The study investigated the effects of a lack of comprehensive sexuality education (CSE) on secondary school learners. The researchers believed that there was a need to study the effects of a lack of CSE in Lady Frere because studies by Thobejane (2015), Boyer and Dine (1992), Panday, Makiwane, Ranchord and Letaolo (2009) and Mkhwanazi (2010) indicated that a lack of CSE could have negative effects on learner's psycho-social wellbeing. Also, an article written by Ketting, Brockschmidt and Ivanova (2021) found that comprehensive sexuality education programmes are appreciated by learners as a source of information on sexuality; and that these programmes match with more active contraceptive use and lower teenage pregnancy rates. Furthermore, the article stated that there is a need for more inquiries on establishing a contributory relationship between CSE and teenage sexual and generative well-being. Lastly, Fernandez et al. (2020) state that a valuation of the usefulness of sexual education programs is needed, especially regarding the opportunities presented by new technology.

Year after year, the Department of Basic Education (DBE) faces the challenge of learners falling pregnant whilst in school. Research indicated various contributors to the increased numbers, such as peers, absence of parental supervision and role models (Thobejane, 2015) and rape, among other things (Boyer & Fine, 1992). In 2000, the DBE

introduced sex education into the curriculum through Life Skills for grades R to 6 and Life Orientation (LO) for grades 7 to 12. Life Skills Curriculum and Assessment Policy Statement (2012, p. 8) state “Life Skills is concerned with the social, personal, intellectual, emotional and physical growth of learners.” On the other hand, Life Orientation Curriculum and Assessment Policy Statement (2012, p. 8) state “Life Orientation addresses skills, knowledge, and values about the self, the environment, responsible citizenship, a healthy and productive life, social engagement, recreation and physical activity, careers and career choices.” Since the introduction of these subjects, teenage pregnancy rates continued to rise and unhealthy sexual behaviours continued to be a concern in most schools (Morake, 2011 as cited in Mothiba & Maputle, 2012). In the past, the challenges of teenage pregnancy and rape were common mostly in urban and township schools, but nowadays, schools in rural areas also face this challenge (Panday et al., 2009).

For example, In 2019, a secondary school in Lady Frere had about eight pregnant learners from grades 9 to 12. The same school faced the challenge of learners engaging in sexual activities on the school premises during tuition time. Sometimes, learners bunked class to meet in the toilets or behind classrooms between water tanks. Behaviour like this occurred when the learners were not being supervised. Mkhwanazi (2010) states that this behaviour does not only pose the risk of teen pregnancy but also of contracting sexually transmitted infections (STIs) and increases cases of abortion among teenagers. Stanger-Hall and David (2011) define sex education as the teaching of matters pertaining to human sexuality, together with emotional relations and responsibilities, humans’ sexual composition, sexual activity, reproduction, consent age, reproductive well-being, generative privileges, protected sex, birth control and sexual abstinence. Sex instruction, which encompasses all these features, is known as comprehensive sexual education (Stanger-Hall & David, 2011).

Comprehensive sexuality education is incompatible with the spiritual and social customs of the community and therefore, concerns have been reported regarding its appropriateness in society. A study by Zulu, Blystad, Haaland, Michelo, Haukanes and Moland (2019) on sexual and reproductive health in Zambia found that inadequate and unevenly distributed knowledge led to considerable sexual and reproductive health-related problems among youngsters. It further found that CSE was handled in a haphazard way, allowing educators much room to determine how, when and what to instruct, as well as what should be left out (Zulu et al., 2019). South Africa has developed lesson plans for educators to use for classroom preparations as well as teaching guidelines (DBE, 2019). Not giving learners the information, they need is one of the factors that lead to increased rates of teen pregnancy (Mothiba & Maputle, 2012; Stanger-Hall & Hall, 2011). In the study conducted by Zulu et al. (2019), a teacher reported that information on contraceptive methods, comprehensive sex education and the mythologies related to these was withheld from learners. Using discretion to modify what to teach as the safest tactic to protect the children from engaging in sex does not assist with the implementation of the programme. It must be noted that not only are the learners at risk of contracting infections/diseases, but pregnancy rates will also continue to rise. This is what encouraged the researchers to look at the effects of the lack of CSE in secondary schools.

Objective of the study

- To determine the effect of lack of comprehensive sexuality education on learners’ psych-social being in secondary schools in Lady Frere.

Literature Review

Rijsdik, Ruiter, Leerlooijer, De Haas and Schaalma (2011) state that unsafe sexual behaviour among teenagers was widespread in many countries. This behaviour was reflected

in teenagers beginning to have sexual intercourse at a premature age, a significant amount of unsafe sexual contact and numerous sexual partners among sexually active adolescents. Forced sexual contact between adolescents was also a key challenge throughout the world. Bhana, Crewe and Aggleton (2019) relate this behaviour to differences in financial and socio-cultural dynamics, youngsters involved in business and intergenerational sex. These effects were due to learners' inadequate and/or inaccurate knowledge of sexuality. Drawing from other countries experiences, Finland made sexuality education compulsory in 1970 (Apter, 2011) owing to an increased rate of abortion and deliveries among adolescents. These rates decreased from 1970 until 1994, when sexuality education became optional. The study by Apter (2011) further showed that by 2002, there was an increase in the number of girls aged 14 to 15 years who engaged in sexual intercourse and so did the rate of girls who were not taking contraceptives. After seeing the increase in abortion and delivery rates, the government of Finland made sexuality education compulsory again in 2006 (Apter, 2011). An increase in the prevalence of HIV from 1986 to 2001 in Nigeria compelled 80 organisations to adopt guidelines for CSE in the country (Esiet, 2010). The researchers are of the opinion that a lack of CSE does not only pose a risk for teenage pregnancies or abortions among young people, but it also increases the risk of contracting HIV.

A study conducted by Ketting, Brockschmidt and Ivanova (2021) showed that sexuality education in the Netherlands has had a comprehensive appeal despite the fact that the country does not have a general education curriculum. Schools are given the option of developing their own syllabus considering their context. The study revealed that sexuality education is well developed in the Flemish-speaking part of Belgium, whereas in the French-speaking part development of sexuality education is much slower. In Switzerland, CSE programs are in place in all three main languages. While in England sexuality education is not yet comprehensive because sexuality education is not yet compulsory in fee-paying schools and independent schools and also because the curricula tend to be limited in terms of the issues addressed, concentrating nearly on disease prevention, with a positive approach to sexuality rather missing. In Spain, there is no national law that supports sexuality education that has been adopted. Ketting, Brockschmidt and Ivanova (2021) are of the view that sexuality education topics are or can be integrated into several mandatory teaching subjects in primary and secondary school. Some of the more sex-positive educators found creative ways of dealing with these restrictions by gaining the trust of their learners, encouraging learners to ask questions that they could respond to (in cases where there were restrictions on bringing up the topic), not reporting all discussions conducted in the session, and using out-of-school options like a youth centre, youth-friendly services, or outreach programmes to provide condom demonstrations and/or contraceptive access could be a useful tactic.

The rationale of sexuality education should be to create a model of liberating, notable, and emancipating sexuality; for this purpose, it is necessary to have adequate comprehensive sexuality training. There is a need to have adequate comprehensive sexuality education. The findings of the study conducted by Essop et al. (2018) revealed that we cannot overlook that the environment in which adolescents currently live has transformed drastically. Therefore, it is crucial that ICT (internet, social media) should be incorporated as a means of teaching sexuality education, which opens up a platform for new opportunities for the promotion of sexual and generational health (Rodríguez-Castro et al., 2021). A study by Ketting, Brockschmidt and Ivanova (2021) showed that a need for more tools at schools directed at the sexual and reproductive rights, needs and aspirations of young people living with HIV was expressed. The study further indicated that all the adolescents encountered in the study were enthusiastic about receiving CSE in the future. This shows that teenagers need these sessions, which could be mostly interactive, where questions will be probed and progressive discussions be held.

Studies indicate that the challenge when teaching CSE is that pupils have a lot of questions about sex and relationships and some educators offering sexuality education at schools are not comfortable talking about such (Francis and DePalma, 2014). This is partly due to the fact that the syllabus being used at schools does not unambiguously address certain issues, and at times, when offering CSE in schools, the government's education guidelines on providing life skills prohibit teachers from providing more explicit information on contraceptives and condoms, sex, and masturbation. In South Africa, comprehensive sexuality education was incorporated into the Life Orientation and Life Skills curriculum in 2000 (CAPS, 2012). But the rate of pregnancy among adolescents has been on the rise, unhealthy sexual behaviour, low school performance for teenage parents, and school dropouts have been evident in South African townships and rural areas (Essop et al., 2018). Though LO and Life Skills syllabus have a sexuality education component, teachers responsible for teaching these subjects are reluctant to give learners information that they need to make informed decisions. This is because some teachers mistake sexuality education for sex education (Koch and Wehmeyer, 2021) and this results in them not teaching some topics in class. It is therefore important that teachers be given pre-training prior to teaching Life Orientation/Life Skills and in-service training be provided for educators already teaching the subjects. This will ensure that the information that is passed to learners at different schools is the same so that even when they engage with their friends, they are able to make informed decisions based on what they have heard at school. The study, therefore, sought to answer the question, 'What is the impact of the lack of CSE on the well-being of learners in secondary schools in Lady Frere?'.

Theoretical framework

The study was informed by critical theory. Bohman (2005, p.1) states that, "a critical theory provides the descriptive and normative bases for social inquiry aimed at decreasing dominion and increasing freedom in all forms." This theory was a form of reasoning intended not only to understand, but also to convert society's way of doing things. For this study, critical theory was used to analyse findings through creating a world that fulfilled the desires and influences of adolescents. The study sought to contextualise theoretical statements to reality and ethical universality without lessening them to societal and historic circumstances.

Research Methodology

Approach and design

The study used a qualitative descriptive case study research design. A descriptive research design is a truth-finding method associated mainly with the current and theorising generalisation by the cross-sectional study of an existing situation (Shuttleworth, 2008). McCombes (2019) describes a case study research design as an inclusive inquiry in a certain field, such as an individual, group, place, event, organisation, or a phenomenon.

Population and sampling

The population of the study consisted of learners and teachers of two senior secondary schools situated in Lady Frere, Eastern Cape, parents and religious leaders. Convenience sampling technique was used to select the 2 senior secondary schools. Etikan, Musa and Alkassim (2016) describe this technique as one in which representatives of the population are selected for their ability to satisfy specific conditions, such as easily accessible, same vicinity, availability at a given time and being preparedness to participate in the study. Purposive sampling technique was used to select 13 participants, which consisted of three LO educators, two pastors from the Christian community, six learners (male and female) and two parents

from the community which either of the above schools serves. Purposive sampling technique targets rich information participants (Creswell, 2018).

Data collection method

Open-ended interviews were used to collect data. The researchers employed open-ended interviews that concentrated on obtaining rich, in-depth details about the perspectives of participants regarding CSE. The participants were contacted by means of telephone calls and WhatsApp messenger. Appointment times were scheduled after agreeing to the times and dates. Participants were very cooperative, and the interviews were successful. Each interview took approximately 25 to 30 minutes. Interviews were tape recorded to ensure capturing of every detail given by the participants. The use of open-ended interviews in the study assisted the researchers in gathering information pertaining to participants' behaviour, experiences, attitudes and opinions, and awareness.

Data analysis

Thematic frames that emerged from the data collected coded participants' verbatim quotations and thick descriptions were used to present and analyse data. The researchers closely examined the data and identified common themes which were presented under the results.

Results

The data collected through open-ended interviews with learners, teachers, parents, and religious leaders from the two rural schools were presented using themes and participants were given codes to protect their identities. Participants were asked to respond to the questions that was based on the effects of the lack of CSE teaching and data collected showed that there was a consensus that pregnant girls did not pay attention in class. They either fiddle around, disrupt the lessons, sleep in class, always ask for permission to go to the bathroom, chew or eat something, are absent from school, do not complete their homework and so forth. The following verbatim quotations show some of the responses that were collected from participants through interviews.

L2 from School X indicated that, *"Some of the pregnant girls disturb us a lot in class, they always ask for permission to go out from time to time."* This was echoed by L5 from School Y that, *"Some pregnant girls sleep a lot in class, yawn, frown, and some are very rude and cheeky."* The views shown by the learner participants were in line with the views expressed by LO teachers who participated in the study. T1 indicated that: *"These girls give us a headache, they don't do their homework. Some of them are stubborn, some eat or sleep in class."* Adding to T1, T2 had this to say about some of the pregnant girls:

I wish such learners could not come to school when heavily pregnant because you feel for them, they struggle to do even the classwork given. Absenteeism is very high, and they have too many excuses. They are very sensitive to comments and some of them are very cheeky and rude. This forces me to skip some important topics that focus on contraceptives, relationships, etc. for fear that they would think we are discussing them. (T2)

From the responses, it appeared that many learners were not happy with the behaviour of other learners who fell pregnant at a young age. Their behaviour appeared to be disturbing the learning process, which was what has been experienced by teachers as well. Teachers felt deeply sorry for these young learners because they could see that they were struggling, especially when they are heavily pregnant.

As reported by other authors reviewed in the study, young girls fall pregnant at an early age, as was evident when L5 fell pregnant at 14 years old. The researchers had an opportunity to interview "young parents". They shared their views and how becoming parents at a young

age had impacted on their lives and their academics. As portrayed by the media, ‘pregnancy is a beautiful thing’ but not for these young parents.

L4 who became a parent at young age stated:

From the day I found out that I was pregnant, life began to change for me on my academics, family, friends and the little life I was carrying. I lost support from my family, friends and even my baby’s daddy decided to leave me. The worse part was that I even failed academically, it was really a very painful experience.

The stories or experiences of these adolescents differ. Some have happy endings and some do not. L3 narrated a very touching story of how he was negatively affected academically after he became a young parent. He stated that,

After I heard that I impregnated my ex-girlfriend, I reported that to my parents and they started to treat me differently. Whenever, I wanted something, including school material, they would tell me that the money that they were going to give me have been sent to my baby. I started to realise that my parents were no longer supporting me now and this affected me a lot, because I felt like I’m being punished. The type of frustration I was going through made me to break up with her and later I paid less attention to my studies. As a result, I failed the grade that year. (L3)

One of the learners who also became a young parent was forced by the parents to find a job in order to support his child. He regrettably said,

Circumstances pushed me to find job though I was studying and, luckily, got some piece job at the spaza shop where I was working in the afternoons. This helped me because the little cent I got I was able to send to my child. But it was difficult to balance my schoolwork and my piece job as a result I ended up failing that year. (L4)

T2 also alluded to the performance of learners and how learners were affected academically, particularly those who became parents at a young age. He stated that,

Some of our learners do not perform well and this is because of the many challenges that affect them, which include amongst other things teenage pregnancy, drug abuse as well as peer pressure. But the most devastating issue is the teenage pregnancy. I remember in 2020 we had a very bright learner who was excelling in her studies, but she got pregnant, and her results started dropping and ended up not performing well in last year’s examination. (T2).

The two pastors who participated in the study shared the same views on some issues around sexuality and disagreed on some. P1 defined sexuality education as,

“a conduct of a human being, in other words, does this person in terms of behaviour, associate himself or herself correctly in line with his or her gender.” (P1)

Both pastors agreed that sexuality education should be taught at church and at schools, taking into consideration the age of the learners when doing so, to ensure that one is not portrayed as a person who encourages obscenity in the church. P1 said that he looked at the grade 4 lesson plans for CSE and found that the content covered was good, as it had a part that taught young girls the ways that males use to lure them into sexual acts; however, the content should also focus on boys’ conduct around sexuality issues. According to the pastors, the church should be viewed as a family unit and support groups in churches could be one of the strategies that can be implemented to teach sexuality matters. P2 said that these support groups could be youth conferences, women’s conferences and men’s conferences, amongst others, to discuss the issue of sexuality and involve parents. According to P1, Christian leaders are against the implementation of CSE in schools because they are not aware of the depth of the content that learners would be exposed to.

P1 agreed that the aim of CSE was not to encourage learners to be sexually active, but to offer guidance and preventative measures against sexually transmitted infections and diseases, as well as prevention relating to pregnancy. He stated that,

“Teaching our children about these preventions does not mean teaching them to have sex. No doubt, that one way or another, our children become sexually active; therefore, the absence of condoms at school doesn’t prevent learners from being sexually active. So, I suggest that our children should be educated about the importance of condoms so that they could protect themselves from things such as pregnancy and diseases.” (P1)

On the other hand, P2 disagreed with such teachings, as the Bible states that, *‘thou shalt love thy neighbor as thyself’ (Mark 12:31, KJV)*, meaning aspects such as violence, social and romantic relations are addressed by this scripture. His church did not give advice on pregnancy prevention measures but told the youth about the spiritual consequences of sexual intercourse, like soul ties. He further stated that,

“The content of CSE should not be explicit as it would open doors for learners to be sexually abused by teachers.” (P2)

From a parental point of view, the pastors and LO educators had opposing views to teaching their children about sexuality matters, according to their ages.

PM1 revealed that as children grow older, they do things that are not pleasant. Some fall pregnant and others get involved in substance abuse. PM1 reported that,

“As parents in this community we are faced with a challenge of substance abuse and teenage pregnancy. Our children do not listen, no matter how many times we talk to them. My own child got pregnant at the age of 17 years, and she was doing Grade 10. I had to take care of her even though I was not happy with what she did. I think teachers need to do more in moulding our children.” (PM1)

On the other hand, PF2 indicated that the lack of CSE is a challenge because their children grow up with a knowledge gap and with no proper guidance from schools. She said,

“As parents, we do not really talk about sexuality education with our children because we regard sexuality education as a taboo in our households. We always rely on teachers to be the ones who teach our children about these things but it looks like sexuality education is not given enough attention at schools and this is because we see our children either getting pregnant or become drug abusers and to us parents, it makes us to wonder if really the subject Life Orientation, does it still serve its purpose of orientating our children about challenges of life?” (PMF2)

It was clear from the responses that both female and male learners who became parents at a young age were affected academically. Both sexes had to make sacrifices and it seemed they all prioritised the well-being of the baby and compromised academics. These challenges exist because of a lack of comprehensive sexuality education in schools. It also appeared from the results that Life Orientation as a subject is not afforded enough attention by learners and teachers, because the subject is not really get recognised in the higher education sector, so they say. Moreover, pastors seemed to be supportive of the idea of CSE at churches, provided it is done in accordance with the principles of the Holy Bible. Parents indicated that comprehensive sexuality education is a matter of concern that teachers had to put more energy into.

Discussion of Findings

As mentioned earlier, the objective of the study was to establish the impact of the lack of comprehensive sexuality education on secondary school learners in Lady Frere. The study was informed by the critical theory which states that the conflict of ideas and inequalities are crucial in understanding the dynamics of human relations and withholding certain information from learners that they sometimes need to make informed decisions. As this contributes to increased pregnancy rates among schoolgirls. Although adolescents can change their social circumstances, the theory recognises that their ability to do this is constricted by numerous systems of social, cultural and political authority. The study found that the lack of

comprehensive sexuality education is indeed a contributing factor to increased pregnancies in secondary schools in Lady Frere, as seen from responses given by learner and teacher participants. This is because learners revealed that due to a lack of knowledge about comprehensive sexuality education, some ended up falling pregnant and becoming young parents. This can also be seen in studies conducted by Madunagu (2015), Kumar and Srivastava (2020), and Utomo et al. (2020), who found that a lack of comprehensive sexuality education in schools creates a huge knowledge gap for learners; hence, learners ruin their childhood to experience sexuality.

Studies by Roy (2020), Essop et al., (2018) and Koch and Wehmeyer (2021) show that learners are exposed to a lot of information from peers, television and social media platforms. They misinterpret this information and make the wrong choices that have dire consequences. Due to a lack of the right information, adolescents find themselves entrapped in situations that sometimes force them to abuse substances. We see a lot of young people abusing alcohol and unprescribed drugs to the extent that they drop out of school. In addition, some learners revealed that the pregnancies also have an effect on them as classmates, as they are disturbed by pregnant girls sleeping in class, going to the toilet frequently, eating in class, having mood swings and not doing their schoolwork.

Furthermore, the lack of appropriate measures to safely address sexuality issues resulted in learners taking misinformed decisions. And this could be attributed to the fact that LO and Life Sciences teachers find it difficult to discuss some topics in class when they have expecting learners or young mothers. And the fact that the guidance of the learners who have much experience with these matters fail to assist in the discussion of sexuality related issues. Even parents who discover that their children are approaching the teenage stage find it difficult to discuss such matters with their children. This results in these learners discovering information by themselves from their peers wrongfully who lack the same experience and parental care.

The study found that church leaders have this misconception of sexuality teachings when the youth is involved that it is a sin to talk about sexuality matters because they believe that these teenagers are inexperienced, not married and have not gone through any counselling, hence they are reluctant to have such discussions with the congregants. Therefore, it is vital that learners, teachers, parents and religious leaders work together to ensure the effective implementation of comprehensive sexuality education at school, home and places of worship

Conclusion

The study found that the lack of comprehensive sexuality education in secondary schools has an influence on learners' sexuality behaviours and decision-making. Moreover, for education, possibly the ultimate handling of this issue under review is when the treatment of adolescents focuses on goals they can embrace, rather than avoid, and a comprehensive focus on sexual health is altogether an essential component of that paradigm. Despite substantial investment and programmatic interventions, levels of HIV infections, early unprotected sex, unwanted pregnancy and unsafe abortions knowledge among adolescents have changed relatively little. Comprehensive sexuality education is far from being institutionalised in schools where teenage pregnancy poses a disproportionate burden on the government. Even in European countries with the highest HIV and teenage rates, there are relatively few examples of sustainable CSE programmes in the education curriculum. However, this does not indicate a lack of expertise and experience on sexuality issues due to unpublished literature. Furthermore, unless things change, future cohorts of children will be similarly disadvantaged, as recent studies that assessed the impact of comprehensive sexuality interventions in schools have not presented an effect in terms of a reduction in HIV

incidence, STIs or early pregnancies, despite beneficial effects on knowledge and some reported behaviours. School-based sexuality education is effective in improving teenagers' knowledge and understanding of sexual risk behaviour.

Sexual activity is a reality for young people in Lady Frere, which is difficult to comprehend fully. From the findings, it is recommended that information given to adolescents as part of CSE should be relevant and consider learners' age. Furthermore, it should not be the duty of only LO educators to teach sexuality matters, particularly because learners and other subject teachers have no regard for LO. Moreover, there is a need to sensitise parents and religious leaders to take responsibility for educating learners in sexuality issues, whether they are formally teaching sexuality education as part of human development or by supporting awareness campaigns that specifically deal with such issues.

Future studies should focus on the same phenomenon but on a larger scale using a mixed method approach for generalisation of results. Furthermore, future studies should establish the challenges faced in the implementation of contemporary sexuality education in South Africa.

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INVARIANCE OF THE WESTSIDE TEST ANXIETY SCALE BY SEX AND SCHOOL LOCATION AMONG SECONDARY SCHOOL STUDENTS

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Abstract

This study determined the invariance of the Westside test anxiety scale by sex and school location among secondary school students. Using ex-post facto design, a sample of 370 SS1 students was drawn from a population of 4,901 using the multi-stage sampling procedure. The Westside test anxiety scale was used for data collection. Data obtained from trial testing was used to establish the reliability of the instrument using Cronbach Alpha method. An internal consistency reliability index of 0.87 was obtained. Data collected were analyzed using SPSS. The findings revealed that there is no significant difference in the mean test anxiety ratings of male and female students as measured by Westside Test Anxiety Scale revealing that the WTAS is not biased with respect to gender. The findings also showed that there is no significant difference in the mean test anxiety ratings of urban and rural students as measured by Westside Test Anxiety Scale. Based on the findings, it was recommended that only normed instruments on test anxiety like WTAS should be used by researchers to measure test anxiety in order to arrive at accurate findings in their research work.

Keywords: Test anxiety, Test anxiety inventory, Norming, Gender, Location

Introduction

The transformation of global education sector gave rise to measuring students' ability which is done by conducting stringent testing on students. The practice of testing is continually indispensable in educational practices around the world. Tests are developed to compare a sample's quality, aptitude, skill, or knowledge to a predetermined standard that is typically used to determine if something is acceptable or not (Adom et al., 2020). They are used by teachers to assess the progress of their students, by college admissions officers to choose or reject applicants, by personnel experts to hire staff or promote executives, and by psychologists to assist in the diagnosis of personality disorders and mental illness (Encyclopedia of Children's Health, 2021). Test is said to be a tool used in measuring and establishing the skills, knowledge, capabilities, behavior, worth and performance of an individual or a thing and the outcome of learning. Due to the ethics involved in carrying out the procedure in testing, the fear of failure, or not meeting up to standard may arise in individuals, giving rise to anxiety in testing.

Anxiety

One of the frequently occurring emotions that is evident in all human societies and a universal undeniable truth of life that affects a person's success in a variety of scenarios is anxiety. It is a widespread phenomenon that affects how well pupils perform academically anywhere in the world (Emam et al., 2016). According to definitions, anxiety is an emotion marked by tension-like sensations, anxious thoughts, and bodily changes like elevated blood pressure (Felman, 2020). From the foregoing, anxiety can be seen as a state of uneasiness and troubled mind, an individual experiences, in anticipation of an event that is about to take

place. Owing to the fact that test is a tool to measure individual's ability, performance capabilities and outcome of learning, it may often trigger fear and uneasiness of being incapacitated which is generally referred to as test anxiety.

Test Anxiety

Test anxiety is an extreme nervousness arising from an anxiety-inducing test situation which prevents one from demonstrating true potential and therefore lowers performance especially in the academic environment (Karatas, Alci & Aydin, 2013). It is characterized by feelings of nervousness and discomfort paired with cognitive difficulties. The cognitive (commonly referred to as concern) and affective (emotional) components make up the two main factors, which have been overwhelmingly discovered. Students may experience psychological symptoms before, during, and after a test, such as trouble concentrating, insomnia, exhaustion, muscle contractions, abdominal pain, and tremors (Porto, 2013). This leads to the conclusion that test anxiety is a state of unease, worry, and dread of failure that occurs prior to, during, and after exams and is marked by restlessness, irregular bodily movement, and a lack of focus.

Test Anxiety and Students Performance

Various studies have shown that test anxiety affects students' performance; studies like that of (Farhad, et al., 2011; Trifoni and Shahini, 2011) revealed that test anxiety has negative effect on students' academic performance, and this is consistent with the study of Balogun, Balogun and Onyecho (2017). Amalu (2017) found that test anxiety is a strong predictor of academic achievement and must be put at bay if students must perform well. This is because test anxiety disrupts the emotional and cognitive composure of an individual.

Test anxiety and Gender

Some researchers explored gender differences with respect to test anxiety and discovered that females have higher level of overall test anxiety than males (Chapell et al, 2005; Pena, Bono & Pellicioni, 2016; Pagaria, 2020). Cassady and Johnson (2002) explained that one reason for disparity in test anxiety on the basis of gender is that males and female feel same levels of test worry but females have higher levels of emotionality. Onukwufor and Ugwu (2018) in their work stated that female students had more test anxiety than their male counterparts. The research of Iroegbu (2013) also revealed that gender has a statistically significant impact on academic achievement, with female gender outperforming male gender. Gender and test anxiety have been linked in previous studies. According to research like that of Rezazadeh (2009), which looked at the association between test anxiety and gender, female students' mean test anxiety scores were much higher than those of male students, which is in line with earlier studies on the subject (Mousavi et al., 2008). Adetayo (2015) on the other ground stated that there is no significant difference in test anxiety in males and females. Another factor as important as gender that could be a contributor to students test anxiety is school location.

Test Anxiety and School Location

School location on the other hand, which includes urban and rural setting is a factor that unavoidably affects the confidence of test taking in students. Rural areas where schools are located have been proven to have less infrastructures and less qualified teachers as compared to urban areas (Okeowhor et al., 2019). As a result of this, test anxiety might spring up in secondary school students in rural areas due to lack of confidence in test situations. Alam (2013) in a study asserted that urban students are less test anxious compared to their rural counterparts. Barik and Barman, (2019); Ntibi and Edoho, (2017) asserted that there is no

significant difference between urban and rural students with respect to their test anxiety, while Sultan and Bhat (2019) and Goswani and Roy (2017) disagreed, stating that there is a significant difference.

Theoretical Framework

The test anxiety theory developed by Liebert and Morris (1967) explains and distinguishes the psychological and affective aspects of test anxiety. According to them, test anxiety consists of two sub-components namely “emotionality and worry”. They are commonly known as emotionality and worry due to the fact that the components can portray itself physically and emotionally. Worry was conceptually defined by Morris and Liebert as cognitive expression of concern about an individual’s performance while emotionality referred to autonomic reactions which happen to occur under testing situations. The emotionality component is the affective aspect of anxiety and explains the physical reaction of students as it relates to performance. According to Liebert and Morris (1967) the most common symptoms that students experience in testing situations include tense muscles, increased breathing rate, headache, dry mouth, cramps, excessive sweating, fast heartbeat and faintness. The worry component on the other hand connotes cognitive distress which affects attention of the individual, concentration and information processing. This theory relates intensively to this study as it portrays the negative effect of test anxiety on students.

A myriad of studies on test anxiety and its debilitating effect on the performance of secondary school students has been carried out with a lot of suggestions made by researchers on how to minimize it among students so as to have better performances. The problem is however unyielding as the inconsistencies in the performance of students persist over the years in the West African Senior School Certificate Examination as reported by the WAEC chief examiner (2015-2019). Test anxiety is therefore speculated to be a contributor to this problem. In order for the challenge of test anxiety to be properly handled amongst students, the instrument used in measuring it must possess good psychometric properties and must be normed to ensure the authenticity of the instrument.

Norming

Norming is the process of interpreting test results in a meaningful way, including creating standards that are appropriate for the sample size and representativeness and generating predictions based on evidence. Understanding or determining whether an instrument is biased in terms of its use by persons of different genders, locations, races, cultures, and ages is the essence of norming the instrument. The Test Anxiety Inventory or Scale is the name of the tool used to measure test anxiety. A self-report psychometric tool called the Test Anxiety Inventory was created to assess individual variations in test anxiety. Before, during, and after examinations, the respondents are asked to rate how frequently they feel various anxiety symptoms. There are a number of test anxiety inventories that have been created by different authors and are used or updated by different researchers throughout the world. These Test anxiety inventories include the State-Trait Anxiety Inventory (STAI) by Spielberger, Gorsuch and Lushene (1983), Cognitive Test Anxiety Scale by Cassady and Johnson (2002), Sarason Test Anxiety Scale by Sarason (1980), Alpert –Haber 10 Item Debilitative Anxiety Scale by Alpert Haber (1960).

However, of all these measures, this study made use of Westside Test Anxiety Scale developed by Richard Driscoll (2004). This test anxiety inventory was chosen because it is widely spread and used to measure test anxiety in many studies (Talwar et al., 2019; Baig et al., 2018). The WTAS was also the measuring tool in the studies of Desai et al. (2021), Totan and Yavuz (2009) and Pagaria (2020). It is one of the measures approved by the American Test Anxiety Association with a reliability coefficient of 0.88 (Talwar et al., 2019). The

instrument is a brief and easily administered instrument which comes a manual that includes a rating scale to it assist test takers in understanding the meaning of their scores. The WTAS is a ten (10) item, five-point Likert response scale with response options ranging from (1) not at all, never true (2) slightly, seldom true (3) moderately, sometimes true (4) highly, usually true (5) Extremely, always true. The Westside Test Anxiety Scale (WTAS) has been correlated with some other measures of test anxiety like the Spielberger Test Anxiety Inventory (1980), Turkish version of the WTAS and has been found to be a reliable and valid measure of test anxiety (Driscoll, 2004).

A lot of studies have been carried out on students test anxiety and a few studies have also been carried out to assess the authenticity and usage of the instruments used in measuring test anxiety outside Nigeria. To the knowledge of the researchers, no study has tried to look at or examine the norm of some of these instruments used in carrying out research on test anxiety in Nigeria. Most researchers adopt these instruments not knowing whether they are good or bad but because they have been able to gain access to these instruments since they are easily accessible. This situation thereby does not give the leverage to decipher acceptable and standard instruments for measuring test anxiety among students.

Based on the foregoing, the researchers adopted the WTAS in order to norm it on students in Nigeria with respect to gender and location to know if it can be for general use even to students in this part of the globe, and if there is need for modification of the instrument and to ensure there are no anomalies in the instrument. This will help to make meaningful conclusions on its usage.

Purpose of the Study

The general purpose of the study is to establish the invariance of the Westside Test Anxiety Scale by sex and school location among secondary school students.

Specifically, this study sought to:

1. norm the Westside Test Anxiety scale on Nigerian secondary school students based on gender.
2. norm the Westside Test Anxiety scale on Nigerian secondary school students based on school location.

Research Questions

1. What is the norm of the Westside Test Anxiety scale on Nigerian secondary school students based on gender?
2. What is the norm of the Westside Test Anxiety on Nigerian secondary school students based on location?

Hypotheses

H₀₁: The mean test anxiety ratings of male and female students as measured by Westside Test Anxiety Scale do not differ significantly.

H₀₂: The mean test anxiety ratings of urban and rural students as measured by the Westside Test Anxiety Scale do not differ significantly.

Method

Ex-post facto research design was adopted for the study. Ex-post research design was used because the researcher has no control over the variables of interest and cannot manipulate them. The population for this study consists of 4,901 senior secondary one (SS1) students in public secondary schools in Enugu education zone for 2019/2020 academic session. There are 2213, 2155 and 533 SS1 students in Enugu east, Enugu north and Isi-uzo LGAs respectively. The population comprises of 1784 male and 3117 female students (4368 urban

students and 533 rural students). The sample for this study consists of 370 (149 male, 149 female urban students and 37 male, 35 female rural) SS1 students drawn from the population using the Taro Yamane formula for determining sample size. The sample was drawn using multistage sampling procedure.

In the first stage, purposive sampling technique was used to draw two Local Government Areas out of three Local Government Areas within Enugu Education Zone (Enugu North and Isi-Uzo). This is because the researchers are interested in both urban and rural schools. In the second stage, purposive sampling technique was used to draw four co-educational schools from each of the local Governments earlier selected because the researchers were interested in both male and female students. In the third stage, Proportionate stratified random sampling was used to draw male and female students from each of the eight (8) schools that emerged. Hence the total of 370 SS1 students was obtained from the two Local Government areas.

The researchers adopted the Westside Test Anxiety Scale, a ten-item scale rated on a five-point Likert scale of Not at all, never true (1), Slightly, seldom true (2), moderately, sometimes true (3), highly, usually true (4), Extremely always true (5), to seek information on students test anxiety. The instrument was not validated because it was adopted. The internal consistency of the instrument was established on Nigerian secondary school students using the Cronbach alpha method and a reliability coefficient of 0.87 was obtained, which shows that the instrument is reliable and suitable for the study.

The researchers secured approval from the heads of the schools included in the sample for collection of data from the students. The instruments were administered to students through the direct delivery method with the help of two research assistants. Data collected were analyzed using SPSS with the statistical tools of mean and standard deviation. All the hypotheses were tested at 0.05 level of significance using t-test of independent samples.

Results

Table 1

The norm of Westside Test Anxiety Scale on secondary school students based on gender

| Gender | n | \bar{x} | SD | df | t | Sig. (2 tailed) |
|--------|-----|-----------|------|-----|-------|-----------------|
| Male | 186 | 33.39 | 8.12 | 368 | 1.880 | 0.061 |
| Female | 184 | 31.81 | 8.07 | | | |

According to gender, Table 1 displays the mean test anxiety score for secondary school pupils on the Westside Test Anxiety Scale. The average test anxiety score for male students was ($M = 33.39$, $SD = 8.12$), whereas the average test anxiety score for female students was ($M = 31.81$, $SD = 8.07$). According to this, male students scored on average higher for exam anxiety than female students. The standard deviation reveals a small amount of variation. Additionally, the male students' individual test anxiety ratings varied little from those of the female students, as seen by the standard deviations of 8.12 and 8.07 for the male and female students, respectively.

H₀₁: The mean test anxiety ratings of male and female students as measured by the Westside Test anxiety Scale do not differ significantly.

Table 1 revealed that there is no significant difference in the mean test anxiety ratings of male and female students, $t(368) = 1.880$, $p = 0.061$. Thus, the null hypothesis was not rejected.

Table 2*The norm of Westside Test Anxiety Scale on secondary school students based on location*

| Location | n | \bar{x} | SD | df | t | Sig. (2 tailed) |
|----------|-----|-----------|------|-----|--------|-----------------|
| Urban | 298 | 32.37 | 8.09 | 368 | -1.181 | 0.24 |
| Rural | 72 | 33.63 | 8.25 | | | |

Based on location, Table 2 displays the mean test anxiety scores of secondary school students on the Westside Test Anxiety Scale. It reveals that although rural students' mean test anxiety score was ($M = 33.63$, $SD = 8.25$), urban students' mean test anxiety score was ($M = 32.37$, $SD = 8.09$). This suggests that pupils in rural areas scored on average higher for exam anxiety than students in urban areas. The standard deviation reveals a small amount of variation. Besides, the standard deviation of 8.09 and 8.25 for urban and rural students indicate that rural students varied slightly in their individual test anxiety ratings with the urban students.

H₀₂: The mean test anxiety ratings of urban and rural students as measured by the Westside Test Anxiety Scale do not differ significantly.

Table 2 revealed that there is no significant difference in the mean test anxiety ratings of urban and rural students, $t(368) = -1.181$, $p = 0.24$. Thus, the null hypothesis was not rejected.

Discussion of Findings

From the findings, male students scored on average higher for test anxiety than female students. The male students' and female students' standard deviations show that the male students' individual test anxiety levels differed more than those of the female students. Results indicated that male students scored higher but not significantly higher on test anxiety than their female counterparts, hence the null hypothesis was not rejected. This suggests that when placed in a testing setting both male and female students exhibit the same level of test anxiety.

This result is strengthened by the findings of Adetayo (2015) that the symptoms of test anxiety experienced in males and females were not significant. This is also supported by the findings of Sandhu (2016) who reported insignificant difference in the anxiety experienced by male and female students. However, the study is in disagreement with the report of Nunez-Pena et al. (2016) that females reported significantly higher levels of test anxiety than males, though it did not seem to affect their academic grade because their final grades were comparable with that of their classmates. The study is also in disagreement with the report of Onukwufor and Ugwu (2018) that females had significantly higher test anxiety than their male counterparts. The finding does not support the report by Pagaria (2020) which recorded that females have higher test anxiety as when compared to males. The discrepancies in this study could be as a result of sex roles which affect preparation for school activities. This involves some specific domestic works which are to be carried out by boys and those to be carried out by girls, one could be more tasking and stressful than the other. This is consistent with the work of Generosa (2013), Cerrato & Cifre (2018)

The study gives information on the Westside test anxiety scale and its norm on secondary school students as an adequate measure of test anxiety with respect to gender. It is unbiased because the scores of male and female students in response to the items in the instrument have an insignificant difference which may be caused by other factors and not gender differences.

The findings also showed that rural students had higher mean test anxiety score than the urban students. The standard deviations for urban and rural students indicate that rural students varied in their individual test anxiety ratings than the urban students. The null hypothesis was not rejected because urban students showed higher but insignificant test anxiety score difference compared to rural students. This shows that urban and rural students exhibit the same level of test anxiety since the difference between them is insignificant.

The finding of this study is supported by the study of Barik and Barman (2019) which reported that there is no significant difference between urban and rural students in respect to their level of test anxiety. Ntibi and Edoho (2017) also revealed that location does not significantly contribute to the test anxiety of students. The present study is in contradiction with the study of Sultan and Bhat (2019) that rural secondary school students had significantly more test anxiety mean score than urban secondary school students. The study of Goswani and Roy (2017) highlighted that urban students experience more stress than students in rural settings and thereby experience higher levels of test anxiety than students from rural settings. The contradictions could be as a result of teaching and learning factors.

The study gives information on the Westside test anxiety scale and its norm on secondary school students as a standard and unbiased measure of test anxiety with respect to location. The Westside test anxiety Scale has good psychometric properties and internal consistency in that students from urban and rural areas have no problems responding to the instruments. It is clear and unambiguous to be used in measuring test anxiety among rural and urban students. The insignificant differences reported from the tested hypothesis could be as a result of teaching and learning factors as stated earlier.

Conclusion

In line with the findings of the study on the invariance of the Westside Test Anxiety Scale by sex and school location among secondary school students, the following conclusions were drawn; The Westside Test Anxiety Scale is a reliable and standard instrument for measuring test anxiety among secondary school students. The Westside Test Anxiety Scale measures both the worry and emotionality aspect of test anxiety as stated by Liebert and Morris (1967). The Westside Test Anxiety Scale is not gender biased since the disparity between the mean test anxiety scores of male and female students is not significant. The Westside Test Anxiety Scale is not biased with respect to location since the disparity between the mean test anxiety scores of urban and rural students is not significant. The instrument could be used to measure test anxiety with respect to gender and location. Therefore, researchers could use the instruments to measure test anxiety among secondary school students in this part of the globe.

Recommendations

In lieu of the findings of this study, it is recommended that:

1. Researchers should make use of normed instruments like the WTAS in measuring test anxiety in secondary school students in order to get accurate findings in their research work.
2. More awareness should be created on norming of both foreign and indigenous instruments so that more researchers can make use of normed instruments to reduce bias in research
3. Instruments should be normed from time to time to ensure they are not obsolete but appropriate for usage at the time they are being used.
4. A replication of this study should be carried out, norming various other test anxiety instruments on the same area of study.

Limitation of the Study

The study was able to norm just one measure of test anxiety amongst the plethora of instruments used by researchers in carrying out research involving test anxiety

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TRANSITION FROM SECONDARY SCHOOL TO UNIVERSITY MATHEMATICS: A CASE OF FIRST-YEAR STUDENTS' EXPERIENCES OF MATHEMATICAL WRITING

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Abstract

First-year university students in developing countries frequently find themselves in an educational environment that is very different from secondary school, and their preparedness for university studies is becoming more diverse as the university students' population is growing. Numerous studies in mathematics education have concentrated on the first year of university mathematics, particularly the transition of students from high school to university mathematics. Against this backdrop, this study examined first-year students' experiences with mathematical writing. The study sought to answer the question: How did mathematical writing hinder /enabled mathematical learning during the first year at university. Forty eight first-year students participated in the study. Data were collected by means of student's assignment scripts and interviews. Guided by Lave and Wenger community of practice theory, this study employed an interpretative research philosophy to gain insights into participants' experiences of mathematical writing. Data analysis showed that the use of writing in mathematics resulted in an improved understanding of the concept and development voice of authority within the mathematics community. Again, the study reveals that using only mathematical symbols as a mode of communication in mathematics classrooms limits students understanding and obscures the presence of human beings as agents in mathematics activity. A recommendation is made that writing be central part of learning mathematics and students be taught different ways of communicating mathematics including the use of scripted words.

Keywords: Transition, Mathematical writing, discourse, commognition, situated learning theory.

Introduction

The lack of readiness of pupils transitioning from secondary school to university mathematics has drawn a lot of attention (Hoyles, Newman, & Noss, 2001; Faulkner, Hannigan, & Fitzmaurice, 2014). This problem of transition has been recognised for some time. First-year university students frequently find themselves in an educational environment that is very different from the one from which they came (Thomas & Klymchuk, 2012). The rules of discourse change, but nobody states them (Sfard, 2007). Due to conflicting engagement standards in various communities of practice at school and in the university, students' positions imply diverse identity experiences (Solomon, 2007). Mathematical writing and communication skills, institutional changes, social changes, and changes in the subject's substance are all possible outcomes of the transition from high school to university (Alcock & Simpson, 2002). The aim of this study is to examine first-year university students' experiences with mathematical writing. The study was guided by the question: How did mathematical writing hinder /enabled mathematical learning during the first year at university?

The capacity to communicate is necessary for learning mathematics, and this communication ability must be cultivated (Tinngki, 2015). The National Council of the Teachers of Mathematics (NCTM) in the United States suggests that writing should be viewed as an inherent component of studying mathematics rather than as an add-on to mathematics training (NCTM, 2008). According to NCTM's Principles and Standards for School Mathematics, “students who have opportunities, encouragement and support to write in mathematics classes reap the dual benefit: they communicate to learn and learn to communicate” (p. 60). In South Africa, the Department of Basic Education (DBE) states that learners need to develop the correct use of the language of mathematics and be able to communicate appropriately by using descriptions in words, graphs, symbols (DBE, 2011). The degree to which students can comprehend and apply mathematical concepts directly relates to their ability to express them in writing (Moon et al., 2018). Students develop, clarify, and consolidate their thoughts when they convey their ideas (Vale & Barosa, 2017). The clarification and refinement of thinking enable students to learn mathematics and to apply concepts and ideas in testing situations (NCTM, 2008).

Understanding School and University Mathematics

In reviewing studies focusing on school-university transition, Gueudet (2008) categorises organisation of knowledge, thinking mode, proofs, didactical transpositions, mathematical writing, and mathematical communication. In their study, De Guzmán et al. (1998 p. 753) reported that university mathematical learning activities are more abstract, formalised, and rigorous, and “some concepts are acquiring a different status when passing from school to university context.” Both De Guzmán et al. (1998) and Gueudet (2008) contend that formal definitions and proofs of mathematical concepts are essential aspects of university mathematics, and it is the major shift that students are expected to make during their first year at university.

Writing and learning of mathematics

The writing across curriculum movement (WAC), sometimes known as “writing to learn,” emphasizes the importance of literacy in all academic subjects and encourages the use of writing as a tool for learning synthesis (Norwood-Klingstedt, 2020). Prior to the ‘writing to learn’ movement, many educators and scholars viewed mathematics and language as having little in common, and they were distinguished as one having a “scientific” culture, whereas the other has “humanistic” culture. WAC sparked an interest in writing to learn mathematics. Researchers contend that writing in mathematics results in an improved dialogue between students and teachers, which in turn result in students’ omissions and misconceptions being communicated more clearly and critical thinking, understanding and problem-solving improved (McMillan, 2017). Numerous books and periodicals discuss the advantages of combining writing and mathematics (Adams, 2003). Teachers who assign writing assignments in mathematics can examine their students' mathematical reasoning, identify their misconceptions, and assess their own teaching methods (Goldsby & Cozza, 2002). Writing in mathematics stresses the role of organizing thought, comprehension and revising thinking (Morgan, 2001).

Improving student comprehension and giving teachers insight into their students' thinking are some of the pedagogical justifications for employing writing in mathematics classes. (Morgan, 2001; Martinez & Dominguez 2018). Several researchers suggest that the student's capacity to comprehend and use mathematical concepts is directly tied to their capacity to explain those concepts in writing (Anthony & Walshaw, 2009; Bosse & Faulconer, 2008; Matabane & Seo, 2021). When writing strategies are used, students learn mathematical topics more efficiently and with greater understanding (Bosse & Faulconer, 2008). Writing

supports students' growth in communication and reasoning, which in turn develops and extends their understanding of mathematics (Anthony & Walshaw, 2009; Kihara et al., 2020).

Theoretical Framework

This study used Communities of Practice (CoP) framework based on the work of Lave and Wenger (1991). CoP considers learning as a process of joining a strong community rather than as a socially shared cognition that ultimately leads to individuals internalizing knowledge. (Lave and Wenger 1991, p.65). At the heart of Lave and Wenger's (1991) community of practice learning is the notion that learning is fundamentally social and related to an individual's involved identity in a community of practice. A community of practice is defined as a community with "joint enterprise, shared repertoire, and mutual engagement" (Wenger, 1998, p.73). The CoP exists everywhere. Membership involves whoever participates in and contributes to the practice rather than on official status. Participants can take part in various ways and to varying degrees. In some, we are essential participants, while in others, we play a less role. Because of this permeable perimeter, there are numerous learning opportunities as core members interact with less engaged participants. Three fundamental aspects of CoP make it up: what it is (its joint venture), how it works (the relationship of mutual engagement that binds members together), and what it can do (the common pool of communal resources that members have amassed over time) (Lave and Wenger, 1991). The CoP theoretical lens is fitting for this study because, first-year students do negotiate competence in the discourse of mathematical writing at university.

Analytical Framework

The data was analysed using Discourse Analysis (DA) and Seo (2009) analytical theory of communication in mathematics. First coined by sentence linguist Zellig Harris in 1952, DA is a research method for studying written or spoken language in relation to its social context. Conducting discourse analysis means examining how language functions and how meaning is created in different social contexts. The term 'text' is, sometimes, used in place of 'discourse'. (Seo, 2019) asserts that symbols, nominalization, and images make up the three components of mathematical writing. Symbols are marks on a surface, and the context of the mark determines its meaning. (Harris, 1995; Rotman, 2000). Nominalizations are terms with a precise mathematical meanings. Depending on the mathematical context, these words may have different meanings. (Seo, 2015; 2019). Finally, there are images. All writing in mathematics that is not a symbol or nominalization is an image. Graphs and number lines are common images (Seo, 2015; 2019). One or more of these elements may be used simultaneously when pupils write mathematics. These components must be recognized to understand not only what pupils are attempting to say but also how and in what context they are saying it.

This study reports on the challenge of first-year mathematics students in hearing, responding, and creating dialogue. It recognizes their current collections of social and historical information, as well as their metacognition, which improve the opportunities for mathematical writing. This study demonstrates how students' perceptions of mathematical texts as a conversation in progress influenced their writing of texts, reflections, and essays that incorporated characteristics of mathematical writing. Thus, a contextual Discourse Analysis (DA) is an appropriate instructional design for a mathematical writing setting for first-year students. It is called mathematical discourse analysis mainly because students need to think about mathematical writing as having a source, a purpose, a reader, a listener, and an audience. Such a dialogic approach to mathematical writing foreground a speaker/ listener, a reader/ writer, and a response in context. Students need to understand how texts, ideas, and

interaction interact (Halliday, 1994), as well as how discourse, cognition, and society interact (Romano & Porto, 2016), or how social activity, representation, and performance interact (Fairclough, 2001). These students should know that mathematical writing presents multidimensionality and that mathematical writing users exercise multidimensional repertoires for multiple purposes.

Methodology

This qualitative case study was located within the interpretivist paradigm and took naturalistic methodology. First-year mathematics students were purposely selected. Purposive sampling allows the researcher to select individuals that are likely to yield a better overview of the issues under investigation (Leedy & Ormrod (2005). The first-year students were purposefully selected because they have just graduated from secondary school and could reflect on the transition from school to university mathematical writing. The population of this qualitative study was forty-six first year students (28 females and 18 males). Data were collected through analysing of students' assignments scripts and semi-structured interviews. From the 46 students, only 10 students were interviewed guided by the dept of their depth of their assignments response. To validate the reliability of the interview questionnaires, mathematics teachers and researchers reviewed the questions for clarity and specificity. Ethical considerations were made when gathering data. The results of this study are reported using only pseudonyms. Data were analysed thematically, and all qualitative data were coded to examine common themes and patterns (Adu, 2019).

Findings

Elements of Mathematical Writing

The study made examined first-year student's experiences of mathematical writing. When providing their solutions to the mathematical tasks during the transition process, students used all three components of mathematical writing: symbols, pictures, and nominalizations.

Symbols

In their mathematical justifications, every student employed symbols. They employed logograms and numerals the most frequently. As seen in Figure 1, a student named Mogale-Junior (pseudonym), used logograms and connecting verbs such as equivalence (\Leftrightarrow) and equal sign ($=$) to make a logical connection between mathematical statements. Many times, a student's grasp of implications and the equation's sign does not imply that they fully comprehend the mathematical function it denotes (Morgan, 1998). Figure 1 demonstrates the level of mathematical proficiency the student possesses since she used the implication and equal signs correctly and with no confusion of two. In the discourse of university mathematics, the logical connection of mathematical statements is highly valued (Gueudet, 2008).

In starting the proof, the student use the first-person plural "we", moving away from the absolutist image of mathematics as a system independent of human action. The use of "we" indicate that the student has personal involvement with the text portrayed. The student continues the next line and say, "we must", constructing the reader as part of the process. The use of such inclusive imperative in mathematical writing assumes that the writer and the reader have mutual membership of the mathematics community (Rotman, 2000). To conclude the argument, the student demonstrates to the readers that $f(x) = f(y)$ does not imply $x = y$ by providing a counter example of specific numerals -2 and 2, showing that squaring -2 and squaring 2 yields the same results, but -2 is not 2. The use of counter example to disprove is a standard way for mathematicians and characteristic of university mathematical discourse

(Barosa, 2017). Again, the use of counter inclusive narrative, “we must” show that the students understand what he is doing and is confident that he is in the right direction.

3-1 $f(x) = 3x^2 + 2$
 Suppose that $f(x) = f(y)$.
 we must show that $x = y$.
 $f(x) = f(y)$
 $\Rightarrow 3x^2 + 2 = 3y^2 + 2$
 $\Rightarrow 3x^2 + 2 - 2 = 3y^2 + 2 - 2$
 $\Rightarrow 3x^2 = 3y^2$
 $\Rightarrow x^2 = y^2$
 $\Rightarrow x = y$, e.g. $(-2)^2 = (2)^2$
 but $-2 \neq 2$

Figure 1: Example of Mogale- Junior Use of Symbols

Participants reported that learning of mathematics by communicating to the process and using many forms of mathematical writing improved understanding of mathematical concepts. As Monica(pseudonym) says:

At school most of the questions were calculations but in university I answer by a way of explanation, I can express myself better and understand what I am doing.

Belinda (pseudonym)says: *It is amusing, it makes complex things very much easier. I feel like I am doing mathematics, literally*

National Council of Teachers of Mathematics (NCTM) stated that the core of mathematics is efficient communication. The mathematical information becomes inefficient and stagnates in the absence of communication (NCTM, 2000). NCTM lists "Mathematics as Communication" as its second standard after "Mathematics as Problem Solving" (p.12). Many students reported that the use of natural language during the mathematical problem-solving process enabled them to learn how to convey mathematical concepts through text. According to Merlyn(pseudonym),

It is straight forward, and the words makes it easier to understand the context and communicate your ideas better.

Other students likewise held this view. For example, Pheladi (pseudonym)stated, *I love it!!!! We should all be able to express ourselves the way we feel comfortable. University use many many symbols; at times I memorize them but confuse. I express my math understanding more clearly with words, then bring symbols.*

In Figure 2, another student, Dimpho (pseudonym), used logograms in her answer. Unlike Mogale- Junior, we notice inconsistency in the use of logograms. In the first few lines, Dimpho used the symbols A^c and B^c to mean the complement of set A and the complement of set B, respectively. However, as the proof continues, there is now a switch to using different notations (\bar{A} and \bar{B}) but implying the same mathematical concept. Unlike school mathematics, university mathematics has many symbols with the same meaning (Gueudet,2008). While both notations are acceptable, consistency is important. Mature writers use one notation consistently and do not confuse the reader. Inconsistency in the use of symbols suggests lack of mathematical writing maturity or mathematical deficiency (Martin, 2015).

Dimpho starts her solution by writing, “If we take”. By using “If we”, the student is not only drawing her full attention and intimate relation to the task and text but also making an

invite to the reader to be actively involved in the process. The use of the first-person plural “we” is used to emphasising that Dimpho is not seeing herself alone in the process but speaking with the authority of the community of mathematicians that guarantees the generalisable transmissibility of the mathematics discourse (Martin, 2015). The reader is also told, “we must” demonstrating not only the voice of authority but that the reader ought to be interested in the details of the mathematics presented in the text.

$$(ii) A^c \cup B^c \subseteq (A \cap B)^c$$

 If we take $A^c \cup B^c$, we must show that $A^c \cup B^c = (A \cap B)^c$
 Let $x \in \overline{A \cap B}$
 $\Rightarrow x \notin A$ and $x \notin B$
 $\Rightarrow x \notin A \cap B$
 $\Rightarrow x \in \overline{A \cap B}$
 $\therefore A^c \cup B^c \subseteq (A \cap B)^c$

Figure 2: Example of Dimpho's Use of Logograms

In figure 3, another student, Precious(pseudonym), used highly specialised symbols to make her argument. When addressing writers of mathematics papers, Halmos (cited in Steenrod et al., 1973) says, a mathematics text with symbols looks like a computational hash, more frightening and complicated. Excessive use of symbols is because the student assumes the reader is a member of the same community, sharing the ability to read and interpret the symbolic language. In this case, the student made a logical assumption that her lecturer would be the reader of her text. She makes a comment, “Sir, I did not proof (ii) because in class you said we can reverse the arrows”. The student did not only say, “we can reverse”, but she indeed reversed the arrows. The student is aware that the proof can only be complete if the reverse condition is also satisfied. She understands the concept of double implications (\Leftrightarrow) and what it means. Not proving the statements that are trivial, by implication, is a standard practice for members of the mathematics community. While non-mathematicians and some mathematics students have an excessive emotional reaction to the excessive use of symbols, Precious (pseudonym) claims authority as an “expert” member of mathematicians, one who is not frightened and does not consider the symbols complicated.

$$1.4 \quad A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

 $(i) \quad A \cap (B \cup C) \subseteq (A \cap B) \cup (A \cap C)$
 $(ii) \quad (A \cap B) \cup (A \cap C) \subseteq A \cap (B \cup C)$
 $(i) \quad x \in A \cap (B \cup C)$
 $\Leftrightarrow x \in A \text{ and } x \in B \cup C$
 $\Leftrightarrow x \in A \text{ and } (x \in B \text{ or } x \in C)$
 $\Leftrightarrow (x \in A \text{ and } x \in B) \text{ or } (x \in A \text{ and } x \in C)$
 $\Leftrightarrow (x \in A \cap B) \text{ or } (x \in A \cap C)$
 $\Leftrightarrow x \in (A \cap B) \cup (A \cap C)$
 Sir, I did not proof (ii) because in class you said we can reverse the arrow, because also true.

Figure 3: Example of Precious 's Use of Symbols

Nominalizations

Nominalizations are a very condensed mathematical vocabulary, as was previously mentioned. For example, in Figure 2, Dimpho wrote A^c to denote the complement of a set A. People who are unfamiliar with this mathematical term would not know that "complement" means "the set that includes all the elements of the universal set that are not present in the given set". However, Dimpho understands that she is writing to his instructor, a member of the mathematics community who will understand her communication. Only when the writer and reader are conversant in the same mathematical jargon can nominalizations be effective (Seo, 2019).

Images

The data is organized succinctly by images. The student can express a lot of information with just one source (O'Halloran, 2008). Students utilized pictures in addition to symbols to make their mathematics explanations more understandable. In Figure 4, Lesego-Junior used symbols to define the concept of one-one and onto-ness. He then threw a neat diagram to signal to the reader that the diagram is part of the solution and needed to be given attention. The image is used as part of the argument, serving as an explanation and justification. The neatness indicates that the text is formal and there is a distance in the relationship between the author and reader. The distance may be a social one, being a mark of respect to the reader.

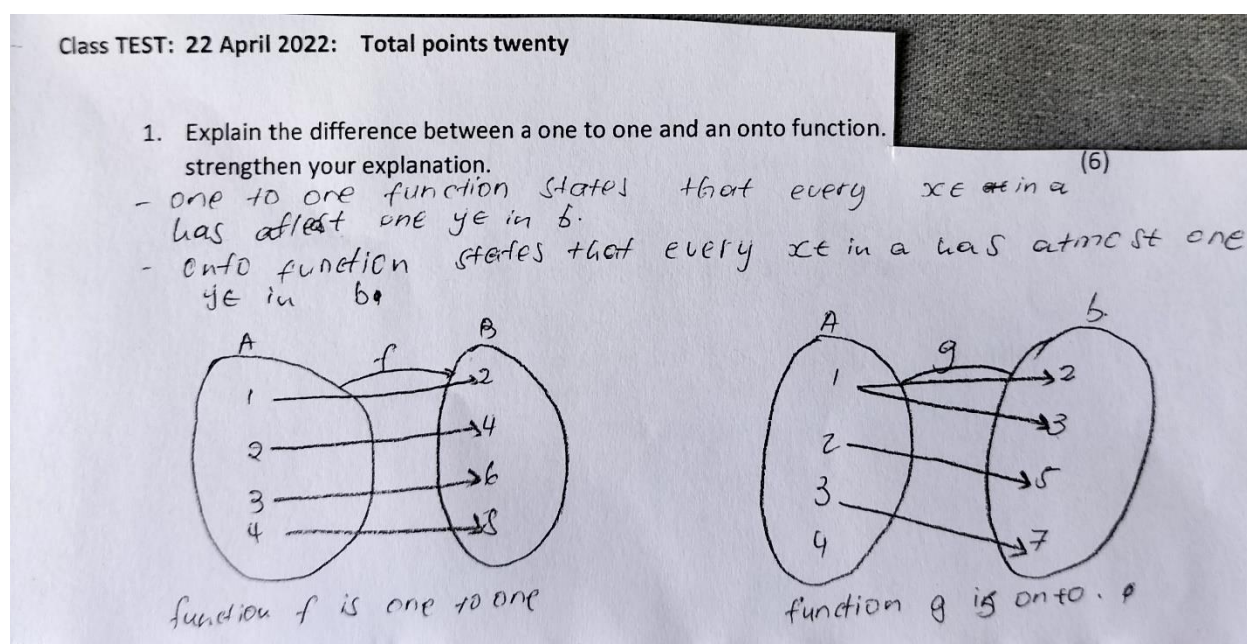


Figure 4: Lesego 's Use of Images

In Figure 5, Thuto (pseudonym) used a rough sketch of Set A and Set B. Unlike in figure 4, where the image was used as part of the solution, in this instance, the image was a rough sketch not used as part of the solution but an organising tool to structure an argument in the solution. Again, the roughness of the sketch might signal the distance between the author and the reader. The distance can be an intellectual one, indicating the degree to which the reader is constructed as sharing the intellectual resources needed to understand the rough diagram.

Although it is not clearly mentioned anywhere that the function maps real numbers to real numbers, the student makes her assumption clear to the reader on what guides her approach to the problem by saying, Since $f(x): R \rightarrow R$, an invitation tone to the reader. While

the student demonstrates a better understanding of the concept of onto-ness, by singling a spectator element in the set of possible outcomes, she clearly missed the mathematics vocabulary and distinction between range and co-domain. The single element of the spectator tells us that it is in the co-domain but not in the range. That is what makes it a spectator, but the student says it is a spectator and at the same time, she says it belongs to the range, a clear contradiction. The use of words and images to complement the mathematics symbols allowed the teacher to easily diagnose misconceptions that the student had in relation to the concepts range and co-domain (Morgan, 2001).

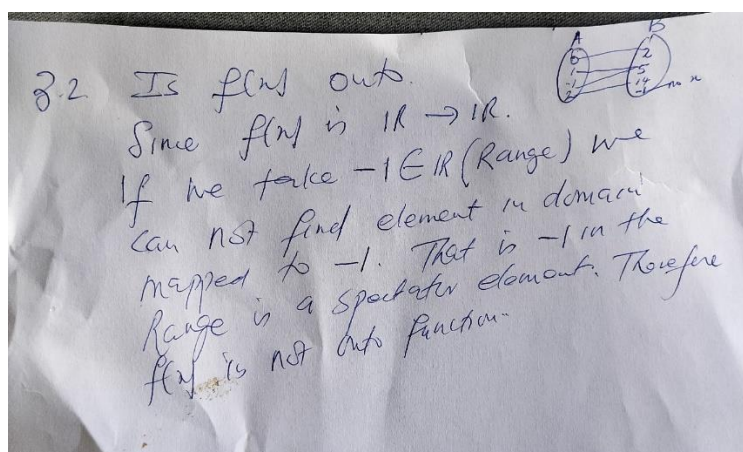


Figure 5: Thuto's Use of Images

Some students did not see the explanation of the ideas behind the symbols as mathematics. Mathematics is usually presented in an absolutist approach with fixed algorithms, without any attempt to explain the process and provide a road map (Moloi & Matabane, 2021). Kgotsotfalo (pseudonym)says:

I have always done well in mathematics, I am good with calculations and solving proper maths problem, but this year was very difficult although I passed. I do not like writing explanations. To these students, learning mathematics is about equations and formulars. However, a list of calculations devoid of any justifications leaves out ideas. The ideas are mathematics. Therefore, students must write both the calculations, and explanations, to show their complete understanding of the mathematical concept (Kuzle, 2013).

Discussion of findings

The results show that the students found the integration of mathematics language and natural language as an effective way of teaching and learning mathematics. The use of natural language and effectively weaving images, symbols and normalizations resulted in improving mastery of concepts (Seo, 2019; Martin, 2015). The opportunity to specifically address the reader in the process of solving the problem allowed the students to effectively structure their thoughts and develop intimate relationships with tests and tests, resulting in better grades and gaining membership in the mathematics community (Matabane & Seo, 2021). While students reported positive experiences on weaving images, symbols and mathematical language, the analysis of students' scripts revealed challenges on taking care of numerical context during problem (Solomon, 2007). Students take it as given that the numerical is always that of a real number, even in the case the questions are posted in the numerical context of integers. There result also challenges regarding the need to use one notation consistently even though there might be other acceptable notions with same meaning. Mature mathematics writers use one notation consistently (Martin, 2015).

Conclusion

The aim of this study was to examine first-year university students' experiences with mathematical writing. The students found the integration of mathematics language and natural language as an effective way of teaching and learning mathematics. The use of natural language and effectively weaving images, symbols and normalisations resulted in improved mastery of concepts, and students were able to express their thoughts better with the language accepted by the mathematics community. The opportunity to specifically address the reader in the process of solving the problem allowed the students to effectively structure their thoughts and develop intimate relations with test and test, resulting in better grades and gaining confidence.

Recommendations

The study recommends that writing be a central part of teaching and learning mathematics and students be taught different ways of communicating mathematics, including the use of scripted words. Future mathematics teachers should be taught how to successfully integrate writing activities in their mathematics classrooms and effectively interlace symbols, images, and normalisations systematically. Such integration of writing in mathematics fosters improved understanding of the concept and higher students' achievement levels in mathematics. It is recommended that future studies look at the extent to which students use words and images to convey the same mathematical meaning.

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ENHANCING STUDENTS' ACHIEVEMENT IN SECONDARY SCHOOL PHYSICS USING ETHNOSCIENCE-BASED INSTRUCTION

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Abstract

This study investigated the effect of ethnoscience-based instruction on students' academic achievement in senior secondary school physics in Nsukka Education Zone of Enugu State, Nigeria. Three research questions and three hypotheses guided the study. This research used a non-equivalent control group quasi-experimental design to examine the effectiveness of ethnoscience-based instruction (ESBI) on students' physics learning. A sample of 223 (103 male and 120 female) SS11 physics students were drawn from 6 out of 46 government co-educational secondary schools in the zone using stratified random sampling techniques. The Physics Achievement Test (PAT) with a reliability index of 0.96 was used to gather the necessary data for the research. While the control group were taught using traditional strategies, the experimental group received instruction based on the ethnoscience teaching method. Analysis of covariance was used to analyse the data collected. It was revealed that ethnoscience-based instruction significantly enhanced students' achievement in physics concepts. It is recommended that physics teachers should be trained on how to teach physics using ESBI in the class to demystify the physics concept.

Keywords: Ethnoscience, Academic Achievement, Gender, Physics.

Introduction

Physics is an ancient and broad field of science aimed to analyze and understand the natural phenomenon of the universe (Oguama & Edeh, 2014). Physics is frequently regarded as the most fundamental science that serves as the foundation for all other disciplines because it describes natural processes in the universe (Adeoye, 2010). One of the scientific disciplines that underpin the physical universe and is continually relevant to people's daily lives is physics. The goal of teaching physics is to examine and comprehend the universe's natural occurrences. Physics education promotes the growth of the economy, industry, and technology (Johnson, 2018). Physics teaching and learning must emphasise activity-based teaching and learning using locally produced source materials for Nigeria to experience economic, industrial, and technical progress. This suggests that physics instruction and learning should be based on cultural and environmental considerations to give students a solid foundation for problem-solving on an individual and societal level and improve their academic achievement in the sciences (Nigerian Educational Research Development Center, 2012). Furthermore, science teaching should be child-centred and culturally sensitive (Nigerian Educational Research Development Center, 2012). Ethnoscience is one of the pedagogical strategies that take into account the environment and culture of the students.

Ethnoscience is a body of knowledge that applies regional knowledge and customs to the solution of scientific problems arising from the natural world (Okwara & Upu, 2017). According to Novika and Fajar (2016), ethnoscience is a body of knowledge that offers explanations of the natural world with applications that arise from a particular cultural context. Ethnoscience can assist physics students to make sense of what they are learning

both in the context of their culture and school physics. It can also help the students to interact with their environment, and construct reality by linking culture to the advanced physics knowledge. By incorporating the students' cultures into their learning of physics, ethnoscience helps in bridging the gap between abstract and concrete understanding of concepts during teaching and learning of physics and makes learning tangible.

Studies regarding the effects of ethnoscience-based instructional strategies on student achievement have been conducted. Abiam, Abonyi, Ugama and Okafor (2016) reported the effectiveness of ethnomathematics-based instruction on students' achievement in geometry and confirmed that the ethnomathematics technique was superior to the traditional way of teaching mathematics. Fasasi (2017) looked into how ethnoscience training affected students' attitudes about learning and their performance in science classes and found that ethnoscience instructional strategies improved students' performance. In their study on the impact of ethnoscience-based instruction on learning science process skills in biology, Ibe and Nwosu (2017) found that the ethnoscience-based instruction group performed better than the traditional practical group. According to Umar and Samuel (2018), ethnoscience-based training did not significantly impact gender-based performance in the sciences.

Science educators and academics are concerned about how gender affects students' science achievement around the world (Ajayi & Ogbebe, 2017). Some researchers discovered a sizable disparity between male and female scientists' accomplishment rankings (Aniodoh & Eze, 2014; Eze & Obiekwe, 2018). Others found no difference between men and women's achievements in science (Abeam et al., 2016; Dike & Rowland, 2020; Segun, 2017). There is a need to understand whether there will be a difference in learners' performance based on their gender when ESBI is implemented in teaching physics in Nigerian secondary schools.

Ethnoscience-related research has been done at many different educational levels. The findings of the studies reviewed on ethnoscience, however, indicate how local culture, learning achievement, science process abilities, and other factors related to the concept of science. According to the research findings also, the ethnoscience approach improved student learning outcomes, even though the majority of the studies were conducted outside Nigeria. Therefore, research into the impact of ethnoscience-based instruction on students' physics achievement in the Nsukka Education Zone, Nigeria is necessary to understand the impact of ESBI on students' learning of physics in Nigeria.

Research Questions

- i. What is the impact of Ethnoscience-Based Instruction on student physics achievement?
- ii. What is the impact of gender on student physics achievement?
- iii. What is the interaction effect of treatment and gender on students' physics accomplishments?

Hypotheses

H₀₁: There is no significant impact of Ethnoscience-Based Instruction on student physics achievement.

H₀₂: There is no significant impact of gender on student physics achievement.

H₀₃: The interaction effect of treatment by gender on students' achievement in physics is not significant.

Method

Research Design

The study used a quasi-experimental research approach: a pre-test post-test non-equivalent control group design. Because intact classes were utilized, this design was chosen.

Participants

A total 2,986 (1618 male and 1368 female students) senior secondary two physics students from 46 coeducational secondary schools in Nsukka Education Zone, Enugu, Nigeria made up the study's population. Coeducational secondary schools were considered because gender is a variable in the study. The focus topic (wave motion) in the study is covered in the SSII scheme of work. Six schools were selected from the zone's 46 coeducational secondary schools using a stratified random sampling technique, and the six functioned as intact classes. Three of the six schools were placed in the treatment group, and the other three were placed in the control group. The groups were divided into treatment and control groups using basic random sampling and balloting. The study's sample size includes 223 (103 male and 120 female) SSII physics students from the 6 intact classes.

Research Instrument

The research instrument for this study is Physics Achievement Test (PAT) which is made up of 50 multiple-choice questions with four possible answers. The PAT was validated by three experts: one physics teacher from a model secondary school in Nsukka, one lecturer from the measurement and evaluation unit at the University of Nigeria in Nsukka, and one lecturer from the physics education unit. Twenty (20) physics students from outside the field of study (ObolloAfor Education Zone) took the PAT for trial testing, and the results were utilized to determine the reliability of the instrument. The instrument's reliability was determined using Kuder-Richardson 20 formula. PAT's reliability was discovered to be 0.96. Due to the items' dichotomous scoring, KR-20 was employed.

Experimental Procedure

Before the start of treatment, the students in the experimental and control groups (pre-testing) took the physics achievement test to ascertain the relative standing of the students with respect to their achievement in physics. The control group received traditional lecture-based instruction while the experimental group used ethnoscience-based instruction to learn about wave motion. The same instrument (PAT) was rearranged and administered to the same students in their classroom after a 5-week teaching and review period (post-testing).

Method of Data Analysis

Mean and standard deviation were used to analyse the data to answer the study questions, and Analysis of Covariance (ANCOVA) with a 0.05 level was used to test the hypotheses.

Results

Table 1

Mean analysis of achievement scores of students based on treatment

| Group | n | Pre-test | | Post-test | | Mean gain |
|--------------|-----|----------|-----|-----------|------|-----------|
| | | Mean | SD | Mean | SD | |
| Ethnoscience | 123 | 12.68 | .94 | 29.69 | 1.49 | 17.01 |
| Lecture | 100 | 12.56 | .95 | 19.10 | 2.02 | 6.4 |

The result revealed that students who learned physics using an ethnoscience instructional strategy had a mean achievement score of ($M = 29.69$, $SD = 1.49$) at the end of the lessons, compared to students who learned the subject through the traditional lecture method, who had a mean achievement score of ($M = 19.10$, $SD = 2.02$). The two groups'

respective mean gain scores of 17.01 and 6.4 indicate that the students who received ethnosience-based training outperformed their peers that were taught using tradition methods.

Table 2

Analysis of covariance of the effect of treatment on students' achievement in physics

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|--------------------|-------------------------|-----|-------------|----------|------|---------------------|
| Corrected Model | 5167.392 ^a | 4 | 1291.848 | 464.363 | .000 | .907 |
| Intercept | 377.118 | 1 | 377.118 | 135.557 | .000 | .415 |
| Pretest | 36.029 | 1 | 36.029 | 12.951 | .000 | .064 |
| Treatment | 4219.726 | 1 | 4219.726 | 1516.807 | .000 | .888 |
| Gender | .009 | 1 | .009 | .003 | .954 | .000 |
| Treatment * Gender | .922 | 1 | .922 | .331 | .566 | .002 |
| Error | 531.358 | 191 | 2.782 | | | |
| Total | 135659.000 | 196 | | | | |
| Corrected Total | 5698.750 | 195 | | | | |

a. R Squared = .907 (Adjusted R Squared = .905)

Table 2 shows that ethnosience-based instruction had a significant effect on students' achievement in physics concepts, $F(1, 191) = 1516.807$, $p = .000$. Besides, the effect size of .888 indicates that 88.8% change in the achievement of students in physics concepts is as a result of their exposure to ethnosience-based instruction.

Table 3

Mean analysis of achievement scores of students in physics based on gender

| Gender | n | Pretest | | Posttest | | Mean gain |
|--------|-----|---------|------|----------|------|-----------|
| | | Mean | SD | Mean | SD | |
| Male | 103 | 12.60 | 1.04 | 25.86 | 5.44 | 13.26 |
| Female | 120 | 12.65 | .90 | 25.70 | 5.40 | 13.05 |

According to Table 3, posttest mean achievement score for male students was ($M = 25.86$, $SD = 5.44$), while those for female students were ($M = 25.70$, $SD = 5.4$). Male students outperform female students, according to the mean gain scores of 13.26 for male students and 13.05 for female students, respectively.

Table 2 shows that gender had no significant influence on the mean achievement scores of students in physics, $F(1, 191) = .003$, $p = .954$.

Table 4

Mean analysis of achievement scores of the students based on treatment by gender

| Group | Gender | n | Pretest | | Posttest | |
|--------------|--------|----|---------|------|----------|------|
| | | | Mean | SD | Mean | SD |
| Experimental | Male | 43 | 12.72 | .99 | 29.81 | 1.57 |
| | Female | 80 | 12.66 | .92 | 29.63 | 1.47 |
| Control | Male | 40 | 12.38 | 1.11 | 18.90 | .70 |
| | Female | 60 | 12.63 | .88 | 19.19 | 2.36 |

According to Table 4, the post-test mean score for male students in the experimental group was ($M = 29.81$, $SD = 1.57$), while the post-test mean score for male students in the

control group was ($M = 18.90$, $SD = .70$). The post-test mean scores for female students in the experimental group were ($M = 29.63$, $SD = 1.47$), whereas those for female students in the control group were ($M = 19.19$, $SD = 2.36$). This demonstrates that the experimental group's post-test scores were higher for both male and female students than they were for the control group's male and female students.

Table 2 revealed that there is no significant interaction effect of treatment and gender on students' achievement in physics, $F(1, 191) = .331$, $p = .566$.

Discussion of Findings

According to the study's findings, there is a statistically significant difference between students who were taught physics topics utilizing ethnoscience-based education and those who were taught the same ideas using the traditional lecture method in terms of their mean achievement scores. As ethnoscience-based instruction brings learning closer to the learners through what they see and hear in their local environment, it is possible that this result was as it was because the students who were exposed to it may have grasped the physics ideas better than their peers who were not exposed to ethnoscience teaching. The fact that ethnoscience-based instruction (ESBI) incorporates ideas, concepts, objects, and materials from the child's cultural environment into its instructional process and uses these ideas to clarify scientific concepts in sciences may account for its relative superiority in improving students' achievement in sciences. This conclusion is consistent with those of Ngozi (2010), Ndirika (2012), Ibe and Nwosu (2017), Dike and Rowland (2020), who found that teaching science concepts using an ethnoscience approach improved students' science achievement more than using the traditional lecture method.

This study's findings also showed that gender had no influence on students' academic performance because there was no discernible difference between the mean achievement scores of male and female students in physics. The result from the study conflicts with those of Abeam et al. (2016), Segun (2017), Dike and Rowland (2020), all of whom independently found that there is no appreciable difference between male and female students' performance in science. This outcome defies the conclusions of separate research conducted by Iodoh and Egbo (2013), Nwaubani et al. (2016), Elejere et al. (2018), and Eze and Obiekwe (2018). The authors found a statistically significant difference between the mean accomplishment scores of male and female students after exposing them to education based on ethnoscience.

Educational Implication

The study has offered actual proof of the effectiveness of instruction based on ethnoscience in assisting students' success in senior secondary school physics. As ESBI gives students a chance to understand science from their cultural viewpoints, it is suggested that physics teachers focus more on using ESBI when teaching and learning physics principles. ESBI is student-centred and activity-oriented, allowing students to actively engage in the teaching-learning process. The underlying indigenous scientific paradigms, methodologies, and concepts that are free from western hegemony and imperialism are essential for understanding scientific reality and should be incorporated into our science curriculum by curriculum architects for sustained progress in the sciences.

Conclusion

It was discovered that ethnoscience-based training was superior to the traditional lecture method for raising students' physics achievement. Using ESBI, it was discovered that male students had somewhat higher mean achievement scores than female students. It may be argued that ethnoscience-based instruction has a greater impact on students' accomplishment

than the traditional lecture method because it stimulates students to actively engage in the learning process by tying classroom learning to their daily lives.

Recommendations

On the basis of the study's findings, the following suggestions are made:

1. Since this study showed that the traditional lecture technique is insufficient for nurturing achievement in science, ESBI should be used in the educational system, especially when teaching physics.
2. Through workshops and seminars, teachers should receive training on how to use the instruction ESBI.
3. The incorporation and emphasis on the use of ESBI in the teaching of sciences, especially physics, should come from government agencies and professional organizations with responsibilities for designing and reviewing the curriculum for secondary schools.

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INQUIRY-BASED LEARNING PRACTICES IN LIFE SCIENCES CLASSROOMS: A SOUTH AFRICAN CASE STUDY

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Abstract

There is uncertainty about the effectiveness of professional development of life sciences teachers to practice inquiry-based instruction, hence, this study explored inquiry-based learning (IBL) practices in life sciences classrooms. The purpose of the study was to elicit valuable and significant insights on the practice of inquiry-based learning (IBL), especially in relation to its application in life sciences teaching and learning. Two objectives foregrounded the study. Firstly, to explore how inquiry-based learning is practised in life sciences classrooms. Secondly, to ascertain how contextual factors influence the practice of inquiry-based learning in life sciences classrooms. The study was guided by a social constructivist theoretical framework and a qualitative case study research design was used. Two life sciences teachers were purposively sampled. Data were collected through semi-structured interviews. Furthermore, non-participant lesson observations were conducted to ensure data triangulation. Findings revealed that the participating teachers demonstrated different conceptualisations of IBL and mainly applied structured inquiry in their classroom practices. Furthermore, it was found that the life sciences teachers' IBL practices were influenced by a myriad of contextual factors such as school settings, policies, and professional development. The study recommends that teachers be engaged in empowering professional development for IBL that includes the development of materials and resources.

Keywords: Inquiry-based learning; social constructivism; structured inquiry; life sciences

Introduction

Inquiry-based learning (IBL) has been adopted as a teaching strategy that is effective in the teaching of science subjects, including life sciences. Almroth (2015, p.168) defines IBL as “an educational strategy in which learners follow methods and practices similar to those of professional scientists in order to construct knowledge”. Furthermore, IBL is a hands-on, learner-centred approach characterised by authentic inquiry activities, wherein learners design and carry out experiments of varying complexity, formulate and test models, and analyse and interpret their own rich data and results (Almroth, 2015; Haury, 1993). Studies with a focus to interrogate the efficacy of IBL in the teaching of life sciences have been conducted; for example, by Timmerman, Strickland and Carstensen (2016) in the United States and Ramnarian (2016) in South Africa. Both these studies' findings reveal that learners gain more comprehensive knowledge when they are taught through IBL-inclined pedagogical choices and that learners become more interested in life sciences when they engage in hands-on activities as they do inquiry.

The findings of a study conducted in Uganda by Ssempala (2017) reveal that the implementation of IBL in developing African countries is challenged by a lack of infrastructure, such as laboratories. South African scholars have also reported that implementing IBL for teaching science subjects, including life sciences, has been derailed by a lack of laboratories at schools, especially those that were previously disadvantaged, mainly because of political issues (Tsakeni, 2018; Ramnarian & Hlatshwayo, 2018; Gudyanga &

Jita, 2019). This study sought to explore how life sciences teachers used IBL in life sciences classrooms. South Africa's life sciences teachers are unsure about the practice of IBL and there is uncertainty about the effectiveness of their professional development regarding inquiry-based instruction (Ramnarian & Hlatshwayo, 2018; Mogofe & Kibirige, 2014). Therefore, the purpose of this paper is to report on a study of how life sciences teachers implement IBL and the contextual factors that influence its practice in the classroom. The study was informed by the following questions:

1. How do life sciences teachers practise inquiry-based learning in life sciences classrooms?
2. How do contextual factors influence the practice of inquiry-based learning in life sciences classrooms?

Theoretical Framework- Social constructivism

The constructivist theory of learning is characterised by the notion that learners construct their own learning and knowledge through their experiences as they interact with the world (Alanazi, 2016). Applefield (2000, p.41) advocates that, "despite the differences amongst the supporters of constructivism, there is an important congruence among the constructivists with regard to the four central characteristics of constructivism, namely, 1) learners construct their own learning; 2) new learning is dependent on learners' existing understanding; 3) social interaction plays a critical role; and 4) authentic learning tasks are essential for authentic learning".

According to Jones and Araje (2002), social constructivism is characterised by a belief that the child develops knowledge through contacts and interactions with people and then later, the child assimilates and internalizes this knowledge adding own personal value to it. Central to the theory of social constructivism is that learning involves both the teacher and the learner, who interactively take important parts in the learning process (Jones & Araje, 2002). Jones and Araje (2002) identify three forms of teaching that follow the social constructivist approach, namely, reciprocal teaching, which involves interactive dialogues between the teacher and learners, followed by turn-taking between the teacher and the learners; peer collaboration, where learners work cooperatively on tasks; and apprenticeship programmes of institutions such as schools, which give learners opportunities to work with experts from various fields (Jones & Araje, 2002).

Grant and Templet (2017) define social constructivism as a method of teaching that emphasises collaboration and social interaction. They emphasise that Lev Vygotsky, who is considered the father of social constructivism, indicates that a learner cannot learn independently, but that the best learning takes place when there is constant social interaction between learners and an instructor or peer who is more knowledgeable (Grant & Templet, 2017). Grant and Templet (2017:68) argue that social constructivism has many components, among which there is the "zone of proximal development, which is described as a zone where learning occurs when a child is helped by others to learn a concept in the class". Social constructivism is suitable for inquiry-based science education and Grant and Templet (2017) postulate that a good social constructivist facilitator is one who will help learners construct knowledge by asking questions.

Amineh and Asl (2015, p.11), in an account of what social constructivism is, point out that "knowledge and understandings of the world are developed jointly by individuals". Vygotsky (1978) in (Amineh & Asl, 2015) argues that cognitive growth and development occur at a social level and then within the individual, which necessitates constant interaction and collaboration between individuals. Other scholars, such as Ernest (1999), Gredler (1997) and Prawat and Floden (1994) concur that knowledge is socially constructed. They emphasise the role played by social and cultural interaction, which results in effective learning.

However, it is important to note that learners' learning during the social interaction is largely dependent upon their social and cultural backgrounds (Amineh & Asl, 2015).

Research Methodology

Researchers believe that “action can be understood when it is observed in the setting in which it occurs naturally” (Kohn & Christiaens, 2012, p.82). Qualitative research is relevant to this study because participants and the phenomenon studied– the practice of IBL in life sciences teaching – were studied in their natural contexts – the classroom – and the researcher was primarily engaged with the participants to make sense and gain an understanding of participants' actions in their contexts (Gaya & Smith, 2016). Furthermore, this research approach is consistent with social constructivism, in which learner interactions in the natural context of learning are significant (Jones & Araje, 2002).

The present study questioned “how” by exploring the practices of IBL in life sciences teaching. According to Baxter and Jack (2008), case studies are relevant when studies seek to answer questions such as how and why. Furthermore, case studies elicit relevant data when the researcher cannot manipulate the behaviour of those involved in the study, when the researcher wants to cover the contextual conditions because they are relevant to the phenomenon under study, and when the boundaries between the phenomenon and the context are not clear (Baxter & Jack (2008). The nature of the study necessitated an exploratory case study, which is used to describe an intervention or phenomenon and the real-life situation within which it occurs (Baxter & Jack, 2008). Creswell (2007) posits that “case study research involves the study of an issue explored through one or more cases within a bounded system. Standerton was the case selected from where two life sciences teachers in two high schools were selected, interviewed, and observed while presenting lessons. The issue studied, in this case, was the practice of IBL in life sciences teaching.

Participants were selected purposively. The application of purposive sampling was justified because the researcher needed participants who possessed valuable information regarding the phenomenon being studied (Palys, 2008; Maree, 2014; Ilker, 2016. Palinkas *et al.* (2015, p.542) state that purposeful sampling “involves identifying and selecting individuals who are especially knowledgeable about or experienced with the phenomenon of interest”. The phenomenon studied in this paper was using IBL in life sciences teaching. The researcher purposively selected teachers who were knowledgeable in life sciences teaching in general and in teaching it through IBL (Ilker, 2016). Participants who were selected purposively were two teachers from two high schools in Standerton, a small town in the Mpumalanga province of South Africa, who taught life sciences in grade 10-12. The two high schools were purposefully selected since they offered life sciences and represented various contexts and backgrounds in that one was well-resourced and the other one was under-resourced. The two participants were females. Participant one had three years of experience in teaching life sciences using IBL. The other participant had been teaching life sciences using IBL for two years. Furthermore, the selection of the two teachers and their contexts were consistent with the basic tenets of social constructivism, which states that learning occurs in a context wherein there is an interaction between learners and the teacher who is more knowledgeable (Amineh & Asl, 2015).

Data collection

Data collection occurred through semi-structured interviews, and data triangulation was sought through non-participant lesson observations. The relevance of the data collection methods used in the present study will be explained briefly and described.

Semi-structured interviews

Semi-structured interviews were used as the main data collection methods. An interview schedule showing the questions was used. The interviews were audio-recorded and transcribed as part of data analysis. Mathers *et al.* (2002) posit that an interview is an important technique that involves verbal communication between the researcher and the participant. Semi-structured interviews, which involve open-ended questions that allow both the interviewer and interviewee to discuss some topics in detail and enable the interviewer to probe for more clarity where the answers are not clear, were used in this study (Mathers *et al.*, 2002).

Semi-structured interviews were relevant in the study as they are flexible and consistent with small-scale research (Pathak & Intratat, 2015). Semi-structured interviews are ideal in a situation where research involves a small number of participants, which was the case with this study as only two life sciences teachers were selected. The teachers interviewed were knowledgeable about the teaching of life sciences and the practice of IBL. The semi-structured interviews used predetermined questions, and where necessary, follow-up questions were asked to elicit more data relevant to the research questions (Stewart *et al.*, 2008; Abawi, 2013). Two schools were visited to interview participating teachers. The researcher administered semi-structured interviews for each of the two participants in the study over a period of two months in the third term, which allowed sufficient time to accommodate the lesson observations that followed for each participant.

Lesson observation

Lesson observations were also used to collect data for the purposes of triangulation using an observation protocol. One of the advantages of observation is that it is a qualitative data collection method that collects first-hand or primary data from the natural context of the phenomenon being investigated (Maree, 2014). In the present study, both participants were observed presenting their IBL lessons – one lesson observation for each participant. Each participant was observed presenting a lesson following an interview that was used for triangulation. Observation provides a deeper understanding of the phenomenon since it provides information on the context in which events occur and may enable the researcher to see what the participants themselves do not see or are unwilling to discuss (Hoepfl, 1997; Maree, 2014). A non-participant observer role was assumed; the lesson presentations were observed without the researcher playing any active role or interacting with the teachers. Instead, their behaviours were recorded (Urquhart, 2015; Maree, 2014).

Data analysis

The data collected for this paper were analysed using thematic data analysis, as it is consistent with and relevant to qualitative data analysis.

Thematic data analysis

Data collected for this study through semi-structured interviews and lesson observations were analysed using thematic data analysis. Thematic data analysis is described by several proponents of qualitative research (Braun & Clarke, 2006; Nowell *et al.*, 2017) as a method for identifying, analysing, and reporting patterns (themes) within data; it minimally organises and describes the data set in detail (Braun & Clark, 2006). Subscribing to thematic analysis, the data collected for this study were organised according to relevant themes that were responsive to the research questions identified. Thematic analysis was chosen as an underlying data analysis method, because an effectively conducted thematic analysis ensures trustworthiness of the findings of a study (Braun & Clarke, 2006; Nowell *et al.*, 2017).

Findings

The analysed data are presented in four themes which are, (1) use of structured inquiry strategies, (2) the perceived role played by teacher professional development, (3) time constraints, and (4) the impact of school infrastructure on IBL practices.

Use of Structured inquiry strategies

The two participant teachers practised structured inquiry. Contextual factors in which they taught life sciences had an impact on their IBL practices. Linda (pseudonym) worked in a school that was well-resourced, and furnished with adequate laboratories. Her IBL practices resonated with the basic tenets of structured inquiry in that both parties – the teacher and learners – had roles during scientific investigation activities, with the teacher providing a more supportive role. Furthermore, after a research question had been posed by the teacher, learners used a procedure given by the teacher to conduct the investigation. Learners were given the apparatus they should use to conduct the investigation and worked in groups to find the outcome, which corroborates the principles of social constructivism. The interview excerpt below describes how she administered IBL.

I give them the aim; they must identify the variables. They have to convert the aim into a hypothesis. I help them to formulate a research question. I also give them the apparatus they should use in the investigation. I show them one thing and they have to do the rest.

The nature of the inquiry that Patience (pseudonym) from an under-resourced school practiced was also a structured type because learners were given the research question and procedures to conduct the investigation by the teacher. She emphasised, furthermore, that she worked with the learners from the onset and guided them towards formulating the investigative question. She did not give learners the autonomy to decide on their own investigative questions; she was the one who provided the questions to the learners. She succinctly explained how the investigative question should be formulated, as follows:

The question will be based on what has been taught. So if we are to do an investigation on a certain topic, what question can we ask? Yeah, drawing questions from what has been taught. And I am the one who poses the question.

Furthermore, she stated that the learners were given the autonomy to formulate their own hypothesis; they conducted the investigation and made observations. Subsequently, the learners drew up conclusions confirming what they had learnt previously, and prepared for classroom discussions to communicate their findings:

My role is just to give them guidance and support. They have to be hands-on. They have to formulate the hypothesis with the help of the educator. In drawing up the conclusions, I allow them to draw up the conclusions confirming the findings they have learnt about. I give them the procedure they should follow during the activity. They write down their findings and discuss them as a whole class. We don't do presentations.

The perceived role played by teacher professional development

The two teachers both received professional training as life sciences teachers at various institutions of higher education. However, the teachers were not confident that they had received sufficient preparation to ensure sound teaching of life sciences through IBL. Linda from the resourced school expressed her doubts regarding professional development in IBL-

inclined pedagogy. Furthermore, she explicitly stated that, during her training to be a teacher, the focus had been primarily on subject content. The interview excerpt below indicates that Linda was uncertain about her professional development and readiness to use IBL in teaching life sciences.

No. Not sufficiently. I am a bit but not sufficiently. I think, I don't know exactly, but I think if I had just studied BA, I wouldn't have been that exposed to life sciences I had with the BSc in physiology. So, I have been exposed a lot of different types of things with dissections. I did it physically. I did all the practicals myself and that helps me a lot with my current practice.

Patience from an under-resourced school was not confident about whether she was sufficiently prepared to teach life sciences through IBL. The training she received during her teacher training years were not explicit in terms of IBL pedagogy. She believed she would still receive professional training in using IBL. In her response, she explicitly spelt out that she was not yet ready to teach through IBL:

With the help of workshops and other assistance I will get better.
Yeah, I will get there. I am not sufficiently prepared yet.

The teachers both indicated that they also had exposure to content workshops as part of their professional development. The workshops were, however, lacking in deliberate training in IBL instruction. Linda was doubtful of the impact the few workshops she attended had on her professional development:

Workshops, I haven't really attended a lot of them, I can't really speak much about those.

Patience had attended several workshops since starting practicing as a life sciences teacher. However, she did not believe that the workshops played a role in her knowledge of IBL, nor her professional development in teaching life sciences. She believed workshops did assist her in her IBL practice, but only to some extent. She ascribed the workshop's lack of contribution to her IBL professional development to the fact that teachers who attended the workshops would have to implement the acquired knowledge at different schools with obviously different contextual factors.

Yeah, workshops do assist even though not completely because of different types of schools that we have. Something may work in another school and may not in another because of things happening in that school and what not.

Time constraints

Linda bemoaned the lack of time to conduct scientific investigations. Her IBL practices were influenced negatively by a lack of time. Her explanation showed that she conducted scientific investigations with the learners, but she was not at liberty to conduct them as often as she would like to, because of time constraints.

I can't conduct them as much as I would like to. I stimulate the learners by using past exam papers but as for telling them to go out and do it; it's something I don't have time for this year. I would have loved to do that. There's no time for me to do this.

She suggested she would be able to conduct such activities more frequently if more time could be offered for her to implement IBL optimally. Responding to a question asking

what she would need assistance on so that she could carry out IBL activities more frequently, she said:

Time. If I can have more time, I can do more scientific investigations.
I can spend time with the children, but I don't have the time.

Patience similarly referred to the time factor as one of the challenges in her practice of IBL. She stated that he could not conduct all the prescribed scientific investigations. The life sciences FET curriculum was congested with content and teachers had to focus on completing it. As a result, she found it challenging to cover the content with the learners and incorporate IBL scientific investigations in her practice. In responding to a question on whether she was able to conduct scientific investigations, at least as frequently as prescribed by the CAPS, she said,

I cannot perform all of them due to time constraints. You know, you have to focus on teaching the content and the time frame is always a factor because you have to cover all the content, which is a lot, against set time limits. You end up doing as much as you can.

The impact of school infrastructure on IBL practices

In this paper, school infrastructure refers mainly to the nature of laboratories and classrooms in which inquiry-based life sciences lessons are conducted. Linda believed that the school she worked at was adequately furnished with the required number of laboratories. She elaborated that she conducted some of her inquiry lessons in the laboratory, of which her school had enough, without stipulating the exact number of laboratories. In explaining how the school's infrastructure influenced her choice of teaching life sciences through scientific inquiry, she said,

We have enough laboratories, so yeah; the infrastructure does allow me to do it.

Patience's inquiry practices as a life sciences teacher were largely influenced by her school having no laboratory. Though she was interested in doing practical work, she worked at a school that was not privileged in terms of being provided with a laboratory. She bemoaned having to work under such circumstances:

And laboratory activities of which we do not have a laboratory at this school. We do not have a lab. In the same classroom where they learn English, that is where they have to learn life sciences and do scientific investigations. So the learners do not get the feeling.

Discussion of Findings

Internationally, literature describes structured inquiry as the type or level of inquiry in which the teacher poses the question to be investigated and the procedure to be followed to answer the question, to the learners, but they are not given the outcome (Whitworth *et al.*, 2015; Smetana & Binns, 2005; Zion & Mendelovici, 2012). Furthermore, learners engage in scientific procedures, which stimulate the development of basic scientific inquiry skills, such as making observations, formulating hypotheses, collecting, and organising data, drawing conclusions, making inferences, and finding solutions (Zion & Mendelovici, 2012). The teacher is present during the lesson and offers support and guidance to the learners (Smetana & Binns, 2005).

The findings of this study reveal that the two participant teachers practiced structured inquiry in different ways, which supported the descriptions in the literature. This finding was also made by Tsakeni *et al.* (2019) in the context of physical sciences teaching in South Africa. The teachers all gave investigative question to the learners, prescribed the methods

the learners had to use to carry out the investigations, and supported learners in drawing their own conclusions after their observations. Linda assumed a supportive role during scientific investigation activities, and learners, in groups, engaged in hands-on activities by following the steps of inquiry practically. She stated the aim of the anticipated scientific investigation to the learners, who then worked to formulate the aim of the investigation. Learners were given the method they had to follow in conducting the investigations. She allowed learners to work together during the investigations and only availed herself when learners needed her support. Once they had reached their conclusions, the groups communicated their findings with other groups by engaging in class discussions.

Patience's IBL practices were also in line with structured inquiry because learners were given the research questions and methods to conduct the investigation. She reported that she worked with the learners from the onset, by assisting them to formulate the investigative question, which implies that she applied some form of scaffolding in the lesson. She did not give learners the autonomy to decide on their own what investigative questions to set. Instead, she provided the questions. Following their observations, learners drew conclusions and communicated their findings through class discussions.

An overarching challenge internationally is that life sciences teachers lack professional development in IBL instruction (Barrow, 2006; Lederman *et al.*, 2013; Papaevripidou *et al.*, 2018; Angraeni *et al.*, 2016). In many science subjects, including life sciences, teachers still do not practice inquiry-based learning due to factors such as teachers' lack of knowledge of IBL and their preference for direct and teacher-centred approaches – tendencies that are attributed to shortcomings in IBL-related professional development (Barrow, 2006).

In the South African context, literature points out that there is an unresolved shortcoming regarding professional development that is intended to prepare life sciences teachers for effective implementation of IBL in their teaching (Dudu, 2015; Ramnarian & Hlatshwayo, 2018). Dudu (2015) posits that teacher development intervention activities in South Africa do not address the needs of the educators and seldom improve the practice of teaching science subjects. This study generated similar results. Teachers who participated attested to several forms of teacher development activities that were meant to contribute to their IBL professional development; however, the teachers pointed out that they were not sufficiently prepared for IBL-inclined pedagogy, which suggests that the teacher training activities were not effective.

The findings of the study corroborate the literature, because the participant teachers did not confidently attest to the contributions of their university training in preparing them to implement IBL. The participants had both received professional training as life sciences teachers at various institutions of higher education. However, the teachers were not confident that they had been prepared sufficiently to ensure sound teaching of life sciences using IBL. The teacher training programmes they had been exposed to effectively only taught them the content of life sciences – IBL-related teacher professional development was lacking.

Internationally literature reveals that teacher development activities focused on preparing teachers to implement IBL are not always effective (Lederman *et al.*, 2013). Similarly, literature states that IBL-oriented teacher development activities such as workshops are not effective in preparing teachers to implement IBL (Dudu, 2015; Ramnarian & Hlatshwayo, 2018). This study generated findings supporting the findings in the literature. The findings of this study reveal that the participant teachers were exposed to some life sciences content workshops. The workshops, however, did not elicit the desired outcomes in terms of preparing the teachers for IBL practices. Patience had attended several workshops since starting work as a life sciences teacher. However, she did not report the workshops as having played a role in her knowledge of IBL, nor her professional development for teaching life sciences through IBL.

In the international context, literature reveals that life sciences teachers face challenges related to allocating time for teaching while implementing IBL pedagogy (Barrow, 2006; Van-Diepen Scheerboom, 2017). South African teachers of science are no exception, as scholars explain that teachers must implement IBL in the face of too little time available (Ramnarian, 2016; Motlathledi, 2015). Furthermore, “time constraints are a complex phenomenon. Inadequate practical skills, large administration workloads, large content or complex content, may all lead to challenges that can manifest as time constraints” (Gudyanga & Jita, 2019). The findings of this study also reveal that the two teachers experienced time constraints in different ways, which had a negative impact on their IBL practices. The findings of this study reveal that teachers in this study found it challenging to allocate time for IBL practices. Other factors, such as the congested life sciences curriculum, threatened their autonomy to use IBL pedagogy optimally. Time constraints, therefore, impacted the IBL practices of the participant teachers negatively. It was challenging to conduct inquiry activities with so much focus on teaching all the topics prescribed by the curriculum.

School infrastructure refers to the availability and the state of laboratories and classrooms in which inquiry-based life sciences lessons are conducted. Internationally, it is well-documented that some schools lack appropriate teaching materials, such as science laboratories, which negatively affects teachers’ confidence in using inquiry-based pedagogical approaches to teach science (Kang & Keinonen, 2016). The findings of a study conducted in Uganda by Ssempala (2017) reveal that the implementation of IBL in developing African countries is challenged by a lack of infrastructure, such as laboratories. South African scholars have also reported that implementing IBL for teaching science subjects, including life sciences, has been derailed by a lack of laboratories at schools, especially those that were previously disadvantaged, mainly because of political issues (Tsakeni, 2018; Ramnarian & Hlatshwayo, 2018; Gudyanga & Jita, 2019).

The findings of this study do not entirely support the literature in this regard because Linda was from a resourced school, which had enough laboratories, Patience was from an under-resourced school that did not have a laboratory. Therefore, Patience implemented IBL activities in an ordinary classroom that had no science material whatsoever. This affected her IBL practices negatively, as learners had no exposure to real scientific contexts and could not experience the feeling of simulating scientists while they worked.

Conclusion

Education systems in the world, including the South African basic education system, are gradually employing pedagogical approaches that accommodate IBL in the teaching of life sciences. However, the study found no evidence of sufficient teacher training in IBL among the participant teachers. Furthermore, the teachers only practised IBL in the form of practical work – a practice that could arguably be attributed to insufficient training in IBL pedagogy. The introduction of IBL in life sciences teaching and learning has been aimed at obliterating traditional ways of teaching, which involve the teacher taking a frontline, more active role, and which relegates the learner to the passive role. The study recommends that teachers be engaged in empowering professional development for IBL that includes the development of materials and resources. Contextual factors pose a threat to IBL implementation in life sciences teaching because most schools do not have the required infrastructure and resources to practice IBL. Interventions should be welcomed by various entities, such as private companies, and the Department of Basic Education, to improve South African school settings and to prepare them to optimise IBL implementation. The envisaged interventions should focus primarily on improving this situation and getting schools ready for IBL implementation, to ensure that the primary goal of IBL, which is producing learners who will think and operate as scientists, is achieved.

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EFFECT OF SMARTPHONE APPLICATIONS ON ELECTRICAL/ELECTRONIC TECHNOLOGY EDUCATION STUDENTS' ACHIEVEMENT AND INTEREST IN UNIVERSITIES IN ENUGU STATE

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Abstract

This study investigated the effect of these smartphone apps on the academic achievement and interest of Electrical/Electronic Technology Education Students. The study applied a Quasi-experimental, pretest-posttest non-equivalent control group design for its investigations. The study was conducted at the Enugu State University of Science and Technology and the University of Nigeria Nsukka. Twenty-six students from the two institutions participated in the study. The Standardized Electrical/Electronic Technology Achievement Test (SETAT) and Interest Questionnaire were adopted and used to collect the data for the study. Data collected were analyzed using Mean and standard deviation to answer the four research questions. The analysis of Covariance (ANCOVA) was also used to test the six null hypotheses. It was found that Smartphone Apps had a positive effect on the student's academic achievement and students' interest. It also found that gender affected students' academic achievement and interest in electrical/electronic technology. Based on these findings recommendation was made.

Keywords: Electrical/Electronic, Technology, Smartphone Apps, Academic Achievement

Introduction

Smartphones have become one of the technology tools of choice for people in all spheres of life. The devices have evolved over the years from telephones in peoples' homes to cellular phones in peoples' hands and pockets to more sophisticated ones (smartphones) that exist today. The smartphone is designed to make and receive voice and text communications like conventional phones. It can access the internet facility, making the smartphone a handheld or mobile computer. According to Nnadozie et al. (2015), a smartphone is a mobile technology device that serves as a medium of communication, offers advanced computing abilities, and access to Internet-based resources. In the view of Osazee-Odia (2016), the smartphone is a new class of mobile devices with advanced features and functionality beyond traditional functionalities and computing and wireless communication capability, representing a classic illustration of convergence and digitalization medium. Therefore, smartphones are those standard electronic handheld devices that can be exploited for their full computing functionality and internet accessibility that could improve the teaching and learning of Electrical/Electronic Technology.

The fascinating features of smartphones make them so indispensable for young people. Smartphones provide interactive features for an increasingly more comprehensive user (Alson & Misagal, 2016), which has become an integral part of everyday student's life. Recently, it is common knowledge that students in universities, including those that offer Electrical/Electronic technology, spend much of their time on their phones chatting, gaming,

and watching movies, and so on, sometimes to the detriment of their academic achievement or success.

Electrical/Electronic Technology is an educational programme designed to provide skills to electrical/electronic students to help them earn a living. These students would, in line with the goals of the programme, become enterprising and self-reliant with skills in domestic and industrial installation, as well as operate, maintain and repair electrical and electronic equipment, among others, after graduation (Orji 2021; Orji & Ogbuanya, 2018; Orji & Ogbuanya 2021). According to Sarimah and Dahiru (2015), Electrical/Electronic Technology Education is an educational programme that equips students with profound knowledge and skills by integrating theoretical and practical courses. Orji and Ogbuanya (2021) stated that Electrical/Electronic Technology is one of the areas of specialization in technical education that employs a skill-oriented method of teaching and learning in imparting valuable skills and knowledge that will help the student to be self-reliant in the field. Electrical/Electronic Technology, therefore, is an educational programme designed to equip students with adequate skills, knowledge, and attitude that would make them self-reliant or secure paid employment. The programme includes electricity, electronics, electromagnetism, and communications (Orji & Ogbuanya, 2018). The process should be in tune with modern realities to effectively teach these contents. The use of conventional teaching and learning of Electrical/Electronic Technology nowadays, just like any other courses, will no longer suffice due to rapid technological changes. There is a need for a shift involving technology as a teaching and learning medium. Smartphone applications could be an effective means of helping students in their academic work, considering the amount of time they devote to it for fun, chatting, and gaming, among others. This can happen because of the expanded application software installed in them.

Smartphone applications are the determinant of what function the smartphone can perform. The smartphone application software, otherwise called App(s), is a program designed to enable the smartphone to perform a specific function. Smartphone Applications are those mobile phone tools designed for specific operations in a smartphone to extend their functionality. According to Omolade and Opesade (2017), Apps are defined as computer programs designed to perform specific functions for specific users and for specific purposes. Smartphone apps can be applied in a program that can perform electronic mails, chats, web-based conferencing, message boards and web pages for sharing information resources (Mtega, Bernard, Msungu, & Sanare, 2012). In other words, mobile applications are platforms mainly used in a smartphone that is designed for specific programs that can aid online research in higher institutions, such as portable document format reader apps, Microsoft Office apps, messenger apps, file manager apps, file sharing apps, web browsing apps, and other mobile utility apps. Some of these applications are specifically designed to help or even teach electrical/electronic technology students to gain better knowledge in electrical/electronic technology. Some apps include Electrical wiring pro, Electrician's helper, Every circuit, Droid tesla pro, Electrical Technology, Short circuit analytic version 1.0, Electronics calculator pro, and Lessons in electric circuit app, among others. The focus of this study is Electronics calculator pro and Lessons in electrical circuit apps. This is because of the uniqueness of their design. For instance, the Lessons in the electric circuit app are designed such that they will equip the students with mainly the theoretical aspects of the course. In contrast, the Electronics calculator pro app is designed to put the students through calculation aspects.

Lessons in Electric Circuit v1.3.1 is a smartphone application designed for Electrical/Electronic Engineering and Technology students to ground them in the course. The application is the collection of the different volumes of Lessons in Electric Circuits. According to Kuphaldt (2007), the primary goal was to put readable, high-quality information

in the hands of students. However, the secondary goal was to make the knowledge of electric circuits as accessible as possible. The App is compatible with every Android smartphone. The App is designed to give students the most material that can effectively help them understand electrical circuit concepts. In other words, Lessons in electric circuit v1.3.1 is a smartphone App designed to provide Electrical/Electronic Technology Education students with vital information to help them understand the course better. However, to efficiently construct an electrical circuit with the knowledge from this App, another application is needed to help the students to calculate the ratings and values of the components and quantities in the building of the electrical circuits. The electronic calculator pro makes that possible.

The Electronic Calculator Pro version 1.6.2 is an App designed to help students and even teachers to acquire knowledge in electrical/electronic circuits and the calculations of quantities. In the view of Inukollu, Keshamoni, Kang et al. 1 (2014), the electronics calculator pro version 1.6.2 is an App that can extract content and information on electrical/electronic from the internet, similar to a website. With the downloaded Electronic Calculator, a pre-coded set of content, formulas, and equation on different electrical/electronic areas can be utilized later without an Internet connection. The App was designed to teach calculations to students and trainers, which would enable them to design electrical circuits effectively. The App does this as it is designed with these options: DC circuit, AC circuits, power supply, amplification, filters, semiconductors, identification of components, physics, converters, references, pinout, and calculator. Therefore, the electronics calculator pro version 1.6.2 is a smartphone App that can be used to improve the delivery of the course content of Electrical/Electronic Technology to university students. The smartphone is very enticing and desirable to people, especially young people, so the use of smartphones in recent times has taken a considerable chunk of students' time. Consequently, smartphones, when employed in teaching and learning, may improve the student's interest and academic achievement in Electrical/Electronic Technology.

Academic achievement is a measure based on a pre-set benchmark that shows the extent to which the student has reached or attained the objectives of any course of study. According to Education Evolving (2016), the achievement is an improvement in students' knowledge. It can do, relative to where they started and their full potential, not relative to a fixed grade-based benchmark. In the view of Mahuro and Hungi (2016), the achievement is the ability of the students to witness positive behaviour resulting from their learning outcomes. In other words, academic achievement in this study is a measure of electrical/electronic technology students' goal attainment, usually indicated as a score. Ali, Toriman, and Gasim (2014); MolokoMphale and Mhlauli (2014); Agharuwhe (2013); Adepoju and Oluchukwu (2011); Akinsolu (2010), in their various studies reported that there is a current trend of academic achievement depreciation among students across a wide range of academic level. According to the authors, this decreasing level of students' poor academic achievement has been a result of many factors, chief among which is said to be students' interest.

Interest in a course is vital if any meaningful learning is to be achieved. Interest is the state of an individual's mind towards a particular thing or event, which determines the individual's disposition towards it. Colloquially, interest is a state of feeling towards something, which means care for something that the individual considers essential and has (mostly) positive feelings about (Harackiewicz & Hulleman, 2010). According to Essien, Akpan, and Obot (2015), the interest could be defined as focusing the sense organs on or giving attention to some person, activity, situation or object. Therefore, interest is a relatively enduring predisposition to attend to specific objects and events and to engage in certain electrical/electronic technology education activities. In addition to interest, gender could be

another critical factor affecting the academic performance of electrical/electronic technology education students.

Gender is the character that distinguishes people along the line of being male or female. According to Oriakhi and Ujoro (2015), gender is the range of physical, biological, mental, and behavioural characteristics that differentiate males from females. Gender is a specially constructed phenomenon as society ascribes different roles, duties, behaviours, and mannerisms to the two sexes (Nnamani & Oyibe, 2016). Therefore, gender is that natural factor of being either male or female, which plays a leading role in how an individual perceives, accepts, and reacts to electrical/electronic technology learning content, which goes a long way to determining the level of academic performance. Gender disparity and poor skill acquisition are common biting issues in the Electrical/Electronic programme.

Unfortunately, competencies needed in many types of high-level employment are lacking in most electrical/electronic graduates thus, making the graduates be described by the employers of labour as half-baked and unemployable (Idaka, 2013). A significant mismatch exists between university output and labour market demands (Odukoya et al., 2016). Though in the submission of Rovira (2010), qualification and skills cannot be assimilated just from formal undergraduate studies and classroom works, other ways of learning, for example, self-learning and work experience, are required. The author went further to state that career competence is built in terms of vocational interests and individual values; also, capabilities are developed, through involvement in what students are interested in, thereby increasing their complementary skills and abilities.

According to Nsirik-Abasi and Aniefiok (2013), research on pedagogy indicated that technology like smartphones arouses students' interest together with the dynamic and prosperous information that it offers. Thus, the quality of pictures and the flexibility make the use of smartphones desirable and draw students' interest. It is, therefore, imperative to investigate the effects of smartphone applications on Electrical/Electronic Technology Education students' achievement and interest at the universities in Enugu state.

Hypotheses

The following null hypotheses were formulated and tested at a 0.05 level of significance:

- Ho₁ There is no significant difference in the mean academic achievements of Electrical/Electronic Technology Education students taught with smartphone Apps and those taught using conventional methods.
- Ho₂ There is no significant difference in the mean interest of Electrical/Electronic Technology Education Students taught with smartphone Apps and those taught using conventional methods.
- Ho₃ Gender has no significant influence on students' mean academic achievement in Electrical/Electronic Technology Education.
- Ho₄ Gender has no significant influence on students' mean interest in Electrical/Electronic Technology Education.
- Ho₅ There is no significant interaction effect of instructional methods and gender on students' mean academic achievement in Electrical/Electronic Technology Education.

Research Methodology

Quasi-experimental, pretest-posttest non-equivalent control group design was employed for the study. According to Nworgu (2010), the quasi-experimental design is a design in which pre-existing or intact groups are used the way they occur, where a random assignment of subjects to experimental and control groups is impossible. Therefore, the design was

adopted as there was no randomization of subjects. The design of this study is represented in the figure below:

| | | | |
|--------------------|----------------|----------------|----------------|
| Experimental Group | O ₁ | X ₁ | O ₂ |
| Control Group | O ₁ | X ₂ | O ₂ |

Where O₁ = pretest

X₁ = experimental group

X₂ = control group

O₂ = post-test

Area of the Study

This research was carried out in Enugu State among Universities offering the Electrical/Electronic Technology programme. The study was carried out at Enugu State University of Science and Technology and the University of Nigeria Nsukka, the only Universities in Enugu State that offer the programme.

Population for the Study

The population of the study consists of 26 students of the two Universities in Enugu State; This distribution is made up of 18 second-year undergraduate students from Enugu State University of Science and Technology and 8 second-year undergraduate students from the University of Nigeria Nsukka.

Sample and Sampling Technique

The total population was used for the study because of their relatively small size.

The instrument for Data Collection

A Standardized Electrical/Electronic Technology Achievement Test (SETAT) was adopted for the study (Lammi, 2009). The Standardized Electrical/Electronic Technology Achievement Test (SETAT) developed by Lammi (2009) was used for both the pre and post-test for the two groups. The test instrument contained 30 multiple-choice items, with numbers 1-4 having accurate/false response options, while the rest (5-30) have four response options (a, b, c, or d). An Interest Questionnaire with 9 items having a 5-point rating scale was also adopted from Lammi (2009).

Validation of the Instrument

The validity of the (SETAT) and the Interest Questionnaire was carried out at Utah State University, America. The validity of the test instruments was already established; the researchers did not re-validate test instruments.

Reliability of the Instrument

The reliability of the instruments, the (SETAT) and the Interest Questionnaire, was tested and was established using Cronbach alpha. The reliability coefficient of (α) = 0.82 and (α) = 0.78 were obtained, respectively (Lammi, 2009). The author already ascertained the reliability of the test instruments; the researchers did not re-establish the instrument's reliability.

Experimental Procedure

The two groups (Experimental and control) were first made to respond to the SETAT (pre-test). The course, which is called Device and Circuit in Electrical/Electronics (TEE

204) at Enugu State University of Science and Technology and Principle of Electricity 1 (ITE 233) at the University of Nigeria Nsukka, both with the same content, unit load (2 units) and offered in the second semester of the 200 level of Electrical/Electronic Technology programme. The course was taught to the students in the two schools.

The control was taught the course content using the conventional instruction method, predominantly lecture and demonstration methods. The experimental group, in addition to the conventional method, was given the smartphone apps (Lessons in Electric Circuit v1.3.1 and Electronic Calculator Pro version 1.6.2) to help them to continue to study even after the lesson.

After six weeks of continuous treatment, the control and experimental groups were subjected to the SETAT (post-test), with some adjustments (re-arrangements of numbers and response options) in the test instrument.

The treatment was for two meetings per week of two hours each. The first week was used for the pre-test in the eight weeks that the study lasted. The following six weeks were used for strict instruction for the experimental and control groups. Then the last week (the eightieth week) was used for revision and assessment (post-test)

Data Analysis

The data collected from the pre-test and post-test of the electrical/electronic technology achievement test were analyzed, and the hypotheses were tested with ANCOVA at 0.05 level of significance; this means that any p-value greater than 0.05 is considered not significant thus the null hypothesis is not rejected. The Statistical Package for Social Sciences (SPSS) was used for the data analysis.

Results

H₀₁ There is no significant difference in the mean academic achievement of electrical/electronic technology students taught with the smartphone Apps (Lessons in Electric Circuits v1.3.1 and Electronics Calculator pro version 1.6.2) and those taught using the conventional methods.

Table 1

Test of Covariance (ANCOVA) of the achievement test scores of the pre-test, post-test and the difference between the control and experimental group

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Decision |
|-------------------------------|-------------------------|----|-------------|--------|------|-----------------|
| Corrected Model | 1483.260 ^a | 3 | 494.42 | 20.05 | .000 | Significant |
| Intercept | 23120.528 | 1 | 23120.53 | 937.77 | .000 | Significant |
| Gender | 82.505 | 1 | 82.505 | 3.35 | .081 | Not significant |
| Instructional method | 563.429 | 1 | 563.43 | 22.85 | .000 | Significant |
| Gender * Instructional method | .287 | 1 | .287 | .012 | .915 | Not significant |
| Error | 542.407 | 22 | 24.66 | | | |
| Total | 49171.095 | 26 | | | | |
| Corrected Total | 2025.667 | 25 | | | | |

df = degree of freedom, Sig = significance value, F= f-ratio

Data in Table 1 show a significant difference in the pre-treatment test scores of both the control and experimental group (institution). Also, the post-treatment achievement test scores show a significant difference in the test scores of the control and experimental groups; since p-value <0.001 is also < 0.05= α , the null hypothesis was rejected since the result showed a significant difference between the mean academic achievements of the two groups.

H02 There is no significant difference in the mean interest of electrical/electronic technology students taught with the smartphone Apps (Lessons in Electric Circuits v1.3.1 and Electronics Calculator pro version 1.6.2) and those taught using the conventional methods.

Table 2

The test of covariance (ANCOVA) of the mean interest rating of both the control and experimental group on Electrical/Electronic Technology

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Decision |
|-------------------------------|-------------------------|----|-------------|---------|------|-----------------|
| Corrected Model | 9.724 ^a | 3 | 3.24 | 26.69 | .000 | significant |
| Intercept | 142.066 | 1 | 142.07 | 1169.86 | .000 | significant |
| Gender | .294 | 1 | .29 | 2.42 | .134 | Not significant |
| Instructional method | 4.022 | 1 | 4.02 | 33.12 | .000 | significant |
| Gender * Instructional method | .007 | 1 | .007 | .055 | .817 | Not significant |
| Error | 2.672 | 22 | .121 | | | |
| Total | 297.593 | 26 | | | | |
| Corrected Total | 12.396 | 25 | | | | |

df = degree of freedom, Sig = significance value, F= f-ratio

Data in Table 2 show a statistically significant difference in the mean interest responses of the control and experimental groups. The control group in a different institution from the experimental group had an interest rate statistically different from their colleague in the other institution.

Thus, the null hypothesis that there is no significant difference in the mean interest of electrical/electronic technology students taught with the smartphone Apps and those taught using the conventional methods is rejected since the p-value of $p = <0.001$ is also <0.05 . This is to say that the teaching method significantly affects the electrical/electronic technology student interest in the course.

H03 Gender has no significant influence on electrical/electronic students' mean academic achievement in electrical/electronic technology.

Table 3

The test of covariance (ANCOVA) analysis of the achievement test scores of the pre-test and post-test and the difference between the control and experimental group based on gender.

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Decision |
|----------------------|-------------------------|----|-------------|--------|------|-----------------|
| Corrected Model | 1483.260 ^a | 3 | 494.420 | 20.05 | .000 | Significant |
| Intercept | 23120.528 | 1 | 23120.528 | 937.77 | .000 | Significant |
| Gender | 82.505 | 1 | 82.505 | 3.35 | .081 | Not significant |
| Institution | 563.429 | 1 | 563.429 | 22.85 | .000 | Significant |
| gender * Institution | .287 | 1 | .287 | .012 | .915 | Not significant |
| Error | 542.407 | 22 | 24.655 | | | |
| Total | 49171.095 | 26 | | | | |
| Corrected Total | 2025.667 | 25 | | | | |

df = degree of freedom, Sig = significance value, F= f-ratio

Data in Table 3 show that the mean academic achievement score of male and female subjects did not differ significantly. The achievement score in the pre-treatment of the females and males differed as well.

Thus, the null hypothesis that stated that gender has no significant influence on electrical/electronic students' mean academic achievement in electrical/electronic technology was not rejected since the p-value of $p = 0.081$ is > 0.05 . This is to say that gender has no significant influence on electrical/electronic students' mean academic achievement in electrical/electronic technology.

H₀₄ Gender has no significant influence on electrical/electronic students' mean interest in electrical/electronic technology.

Table 4

The test of covariance (ANCOVA) analysis of the mean interest rating of both the control and experimental group on Electrical/Electronic Technology based on gender.

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Decision |
|-------------------------------|-------------------------|----|-------------|---------|------|-----------------|
| Corrected Model | 9.724 ^a | 3 | 3.24 | 26.69 | .000 | significant |
| Intercept | 142.066 | 1 | 142.07 | 1169.86 | .000 | significant |
| Gender | .294 | 1 | .29 | 2.42 | .134 | Not significant |
| Instructional method | 4.022 | 1 | 4.02 | 33.12 | .000 | significant |
| Gender * Instructional method | .007 | 1 | .007 | .055 | .817 | Not significant |
| Error | 2.672 | 22 | .121 | | | |
| Total | 297.593 | 26 | | | | |
| Corrected Total | 12.396 | 25 | | | | |

df = degree of freedom, Sig = significance value, F= f-ratio

Data in Table 4 show that the interest of the female and male subjects did not differ significantly in Electrical/Electronic Technology. Thus the null hypothesis that stated that gender has no significant influence on electrical/electronic students' mean interest in electrical/electronic technology was not rejected since the p-value of $p = 0.134$ is > 0.05 . This means that gender has no significant influence on electrical/electronic students' mean interest response in electrical/electronic technology.

H₀₅, there is no significant interaction effect of instructional methods and gender on students' mean academic achievement in Electrical/Electronic Technology.

Table 5

The test of Covariance (ANCOVA) Analysis of the mean achievement score of the subjects

| Source of variation | df | Type III Sum of square | Mean square | f-ratio | sig | Decision |
|-------------------------------|----|------------------------|-------------|---------|------|-----------------|
| Intercept | 1 | 23120.528 | 23120.528 | | | |
| Gender | 1 | 82.505 | 82.505 | | | |
| Instructional Method | 1 | 563.429 | 563.429 | | | |
| Gender * Instructional Method | 1 | .287 | .287 | .012 | .915 | Not Significant |
| Total | 26 | 49171.095 | | | | |

on gender and instructional methods variables.

df = degree of freedom, sig = level of significance

Data in Table 5 show the interaction effect of gender and instructional method on the mean achievement score of the control and experimental groups. Table 5 shows that there

was no significant interaction effect of instructional methods and gender on students' mean academic achievement in electrical/electronic technology at $p > 0.05$ for the two variables (gender and instructional method) [$f(1,1) = .287$, $p = .915$]. The null hypothesis was thus not rejected.

H₀₆, there is no significant interaction effect of instructional methods and gender on students' mean interest in electrical/electronic technology.

Table 6

The test of covariance (ANCOVA) of mean interest response of the subjects on gender and instructional methods variables.

| Source of variation | D f | Type III Sum of square | Mean square | f-ratio | p | Remark |
|-------------------------------|--------|---------------------------|-------------|---------|------|-----------------|
| Intercept | 1 | 142.066 | 142.066 | | | |
| Gender | 1 | .294 | .294 | | | |
| Instructional Method | 1 | 4.022 | 4.022 | | | |
| Gender * Instructional Method | 1 | .007 | .007 | .055 | .817 | Not significant |
| Total | 2 | 297.593 | | | | |
| | 6 | | | | | |

df = degree of freedom, p = level of significance

Data in Table 6 show the interaction effect of gender and instructional method on the mean interest response of the control group and experimental group. Table 6 shows that there is no significant interaction effect of instructional methods and gender on students' mean interest response in Electrical/Electronic Technology at $p > 0.05$ for the two variables (gender and instructional method) [$f(1,1) = .007$, $p = .817$]. The null hypothesis was not rejected.

Discussion of Findings

The result of the study revealed that the use of smartphone apps (Lessons in Electric Circuits v1.3.1 and Electronics Calculator pro version 1.6.2) improves the academic achievement of students since the academic achievement of the students taught with only the conventional instructional method differed significantly from those that were taught using the smartphone apps, as $p < 0.001$ is less than the significance level ($p < 0.05$). This is in agreement with Sivakumar (2015), who stated that using Android apps to teach the English Language is more effective. According to Al Fawareh & Jusoh (2017), even lecturers use smartphone apps for correspondence in the project writing of students in the university.

The findings in Table 2 show that smartphone apps can significantly influence students' interest in electrical/electronic technology. In the view of Yu-Je, Chia-Hui, and Ching-Yaw, (2011), in a classroom setting or in learning, interest is required to meet students' intellectual as well as emotional needs; interest can never be imposed on an individual by external forces, but a teacher can help increase the learners' interest. In this study also, there is a positive relationship between interest and academic achievement, in agreement with the view of Adeyemi and Adeyemi (2014) in Ezike (2018), who noted that when students lose interest in their studies, the failure rate will be higher.

Table 3 shows that gender is a significant factor in the student's academic achievement. This is in line with Dorji, Panjaburee, and Srisawasdi (2015) that gender is a factor in academic achievement. The findings in Table 4 show that though instructional method plays a massive role in the level of students' interest in a particular subject matter, also gender affects the interest of the students in electrical/electronic technology. This result supports the view of Zafraïn and Zawith in Shodeinde (2013), who noted that there are apparent biological,

psychological and personal differences between boys and girls, which may be attributed to the upbringing and the expectation of society. The result of this study did not discredit the statement of Shodeinde (2013) that it has been documented that disparity exists between male and female students' performance in these disciplines of electrical/electronic technology.

Conclusions

The study's findings support the idea that using smartphone apps generally has a favourable impact on students' academic interest in and success in electrical and electronic technology. The student's academic success and interest in electrical/electronic technology are strongly influenced by their gender.

Recommendation

Based on the findings of this study, Electrical/Electronic Technology Lecturers and Instructors should, as much as possible, in-cooperate the use of smartphone Apps in the teaching and learning of the course.

Limitations of the Study

The study was conducted in a state with only two universities.

Suggestion for Further Study

A similar study should be carried out using a larger population {of more states and more universities} in Nigeria.

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MISCONCEPTIONS OF GRADE 9 LEARNERS IN MULTIPLICATION AND DIVISION OF FRACTIONS

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Abstract

This article explored how Grade 9 learners solve the concept of multiplication and division of fractions, misconceptions that arise and the root causes of these misconceptions, at a Soweto school in Gauteng. Eight learners were purposefully selected for an interview from the forty Grade 9 participants who were subjected to a written test. Learners' responses to the written test informed the learner's selection of interviewees. This article shows that learners rely on procedural understanding on solving multiplication and division of fractions inevitably leading to misconceptions. Concept gaps in prior knowledge of multiplication and division of fractions seem to be the root cause of the misconceptions. Suggestions on how to deal with the concept of multiplication and division of fractions are also highlighted in this article.

Keywords: Misconceptions, Fraction, Multiplication, Division, Constructivism

Introduction

Multiplication and division of fractions prove a mathematical uphill to learners resulting in the development of incorrect pathways as learners multiply or divide fractions. Bruce et al. (2014) believe that multiplication and division of fractions prove challenging either to teach (educator perspective) or to learn (learner point of view) probably due to the multi-faceted nature of fractions. The complexity of fractions due to multiple constructs may be the result of the obstacles to teaching or learning concepts on multiplication and division fractions. Struggling to conceptualise may result in learners applying formulas they do not understand or resorting to the well-accustomed whole number knowledge. Although misconceptions on the concept of the fraction may spread across all the operations, that is, addition, subtraction, multiplication and division, this article focuses on misconceptions that Grade 9s had, relating to multiplication and division of fractions.

One of the reasons why this study focuses on Grade 9 learners is because of the poor performance in three consecutive years (2012, 2013 and 2014) in the Annual National Assessments (ANA) in South Africa. These revealed major concerns as the mathematics pass rate were 10.8% nationally. Department of Basic Education (DBE) in Gauteng (DBE, 2014, p. 63). Over the three years (2012-2014), the National average percentage mark does not surpass 14%. Despite improving from 12.7% to 13.9% from 2012 to 2013, the national average percentage mark dropped to 10.8% in 2014. Amongst the 10.8% who achieved in 2014, only 3% managed to get 50% or better. This implies that 97% of the 2014 Grade 9 learners had more incorrect solutions than the correct ones in their examinations.

Theoretical Framework

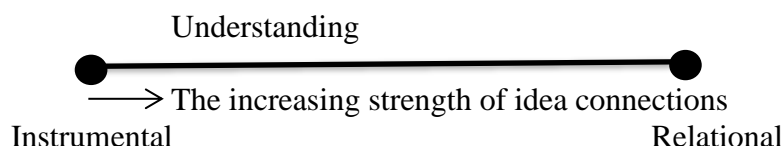
This study is informed by the theory of constructivism whose general principles are based largely on the work of Piaget. According to Van de Walle et al. (2016), the constructivist view entails shifting from direct teaching (traditional approach) to the facilitation of learning by the educator. The educator acts as a guide in the learning setup as opposed to being the source of knowledge. Van de Walle et al. (2016) further state that the

constructivist view is characterised by teaching by negotiation in place of teaching by imposition for the traditional approach. Gardee and Brodie (2015) assert that the theory that proposes active knowledge construction through the use of prior knowledge as a foundation to build new knowledge is constructivism. This implies that according to the constructivist view, learners are actively involved in doing mathematics.

Actively engaged in mathematical activity, learners understand differently as Van de Walle et al. (2016) state that understanding exists along a continuum as indicated in figure 1.

Figure 1

Continuum of types of understanding



The measure of the quality and quantity of connections of an idea to already existing ideas can be thought of as understanding according to Van de Walle et al. (2016). They further explain that at the instrumental end of the continuum, ideas are loosely connected or isolated from each other. This means there is a weak connection of ideas in instrumental understanding. The strength of idea connections increases to the right. On the other end, in a relational understanding, ideas are associated with many others in a rich network of related ideas.

Van de Walle et al. (2016) state that logical relationships constructed internally and existing in the mind as a part of the greater network of ideas form the conceptual knowledge of mathematics. It is the knowledge that is understood. Van de Walle et al. further state that conceptual knowledge is also made up of relationships between objects introduced through mental activity. Conceptual knowledge is the knowledge that showcases an in-depth understanding of a concept.

Another type of knowledge is procedural knowledge which Van de Walle et al. (2016) define as knowledge of rules and procedures for carrying out routine activities. Njisane as cited in Van de Walle et al. uses the word “algorithm” and defines it as a procedure consisting of a finite number of steps leading to the result. In other words, procedural knowledge uses a method of application of a series of steps forming the path towards solution finding. Following the steps correctly without deep conceptual understanding yields the correct solution. Learners getting correct solutions may not necessarily indicate conceptualisation.

Van de Walle et al. (2016) state that understanding relies on the existence of appropriate ideas and the creation of new connections. Consequently, the deficiency of these appropriate ideas may more likely lead to misconceptions. This study focuses on the exploration of misconceptions in Grade 9 learners in multiplication and division of fractions. Thus, in this study, the theory of constructivism is pertinent in the sense that when learners construct knowledge by themselves, misconceptions do arise. This means that misconceptions are part of learning.

Multiplication and Division of Fractions

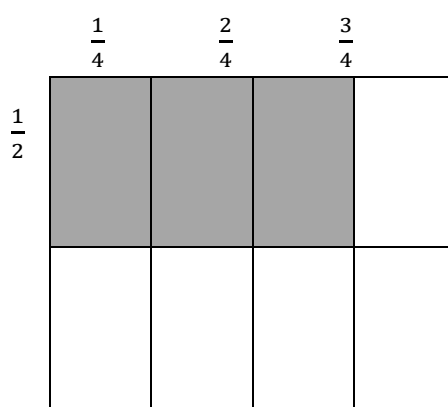
Hackenburg and Tillema (2009) note that the difficulty with the multiplication of fractions depends on the type of fractions being multiplied and the order in which the

fractions are multiplied. Learners are familiar with part of a whole type of problems, for example, $\frac{1}{2} \times 5$.

Bruce et al. (2014) state that the “ \times ” operator is generally interpreted as meaning repeated addition, but when dealing with fractions it means taking an amount of another amount, that is, a part of another fraction. The dual interpretation of the “ \times ” may be the source of conceptualisation hitches as thinking of a $\frac{3}{4}$ being repeatedly added $\frac{1}{2}$ times might render fraction operations abstract. Aksoy and Yazlik (2017) believe that the learner perception of multiplication as additive addition compels learners onto adding fractions instead of multiplying especially when they cannot fit the multiplication problem into their experiences on fractions. The repeated addition approach is no longer convenient in such parts of the types of problem. For such Van de Walle et al. (2016) recommend the use of the area model. Taking from the formula of the area of a rectangle “length times breadth”, quarters are multiplying halves in the problem $\frac{3}{4} \times \frac{1}{2}$. This means one side will be divided into quarters and the other into halves as in figure 2:

Figure 2

Area model representing $\frac{3}{4} \times \frac{1}{2}$



The $\frac{3}{4}$ column and the $\frac{1}{2}$ row meet on covering an area of 3 partitions of the available 8, so the answer is $\frac{3}{8}$. The figure displays $\frac{3}{4}$ of half, the total area shaded, simultaneously presenting the answer relative to the whole area under consideration. The literature provides the misconception that multiplication makes it bigger, and division makes it smaller, and this includes operations on fractions. Graeber and Tirosh (1990) identified the learner notion that multiplication always results in a bigger number and division in a smaller number and considered the belief problematic as it impacts negatively the understanding of operations with fractions.

Olanoff (2011) labels the fair share or partitive model of division as the primitive model as users of the model are bound to face constraints when applying the model in some division problems. For example, $\frac{1}{5} \div \frac{1}{8}$, implies according to the partitive model, share $\frac{1}{5}$ equally amongst $\frac{1}{8}$ people. Difficult to visualise $\frac{1}{8}$ of a person representing the number of people receiving equal shares from the available quantity $\frac{1}{5}$, hence limitations. The fair share

model of division synthesises the misconception that division makes smaller as equally distributing amongst people resembles breaking bulk and having smaller units.

However, the outlined strategies for multiplication and division of fractions come along with misconceptions. Preferences for a procedural approach rather than a conceptual one result from the comparatively less demanding use of algorithms which, according to Bruce et al. (2014), are relatively easy to memorise and apply. Learners may, therefore, exhibit competence in the procedure but conceptually be found wanting. Bruce et al. (2014) further state that the appropriate application of algorithms does not signify an understanding of the concept. Wu (2001) points out that the procedural approach becomes insufficient when dealing with more complex fraction problems.

Research Methodology

The instrumental case study research method was employed in this qualitative methods study (Moyo & Machaba 2021). A written test and interviews were the main sources of data. The data collected from interviews were analysed qualitatively while the data from analysis responses to test questions was quantitatively analysed. To guard against questions that may not bring forth feedback relevant to the study, a pilot was conducted. The pilot also helped adjust interview timing and duplications.

In the larger study, a test was administered consisting of four questions with 15 items in total. For this paper, we have chosen four question items, as indicated in Table 1, which include multiplication and division because they are particularly relevant to our argument.

A class of 40 Grade 9 learners wrote a test on the topic of fractions. The Grade 9 level was the Grade of choice as the researchers assumed Grade 9s have gathered enough experience on fractions through preceding grades. This made Grade 9 learners ideal as potential subjects in the provision of data in misconceptions in multiplication and division of fractions. Based on the test feedback, eight learners were chosen for interviews. On marking the written test, each question was classified in the test in terms of correct, incorrect and partially correct categories per learner. The nature of the learners' responses was recorded per learner, and per question, as shown in Table 2 learners were referenced using codes which were maintained throughout the study, for instance, L1, for Learner 1. There was no specific criterion used when coding. Learners were assigned codes learner 1 (L1) up to learner 40 (L40) according to the way they were seated in the classroom. This way of capturing data helped the researchers overview all the learners' performances. Interviews were tape-recorded to aid researchers transcribe information correctly.

Table 1
Written Test

TEST

Answer all the questions

Show all your calculations where possible

Question 1

Use any strategies to find answers to the following:

1.1 $\frac{1}{2} \times \frac{1}{3}$

1.2 $2\frac{1}{2} \times 3\frac{1}{5}$

Question 2

Use any strategies to find answers to the following

2.1 $8 \div \frac{1}{2}$

2.2 $\frac{1}{2} \div 10$

Findings and Discussions

This section presents the findings and analysis of data in this study. The purpose of the article was to explore misconceptions that Grade 9 learners have in multiplication and division of fractions in a Soweto (township) school. Findings are thematically presented drawing from the analysis of collected data. Apart from the fact that summarising data using tables, percentages and frequencies is linked with quantitative research, tables were used in this qualitative study to help quantify the occurrence of types of misconceptions. This section documents the data analysis process before tables summarising data obtained from written scripts. Each learner's nature of the response to test questions using the codes C, PC and IC where C stands for correct, PC partially correct, and IC stands for incorrect is displayed in Table 2.

Table 2 shows the performance and the percentages of correct, partially correct, and incorrect solutions of all 40 learners who wrote the test. Although the partially correct and incorrect categories are both for solutions that are not correct, the partially correct is for solutions that display an element of concept awareness intertwined with deviations. The incorrect category, however, is for mathematically unacceptable solutions; solutions that show a total breakdown in understanding of the concept of fractions.

Table 2

Categories of learners' responses to each test question.

| | 1.1 | 1.2 | 2.1 | 2.2 |
|-----|-----|-----|-----|-----|
| L1 | PC | IC | IC | IC |
| L2 | C | IC | IC | IC |
| L3 | PC | IC | IC | IC |
| L4 | C | IC | IC | IC |
| L5 | IC | IC | IC | IC |
| L6 | C | IC | C | IC |
| L7 | IC | IC | IC | IC |
| L8 | IC | IC | IC | IC |
| L9 | C | IC | IC | IC |
| L10 | PC | IC | IC | IC |
| L11 | IC | IC | C | IC |
| L12 | IC | IC | IC | IC |
| L13 | C | IC | IC | IC |
| L14 | C | IC | IC | IC |
| L15 | PC | IC | IC | IC |
| L16 | IC | IC | IC | IC |
| L17 | C | IC | IC | IC |
| L18 | C | IC | IC | IC |
| L19 | IC | IC | IC | IC |
| L20 | IC | IC | IC | IC |
| L21 | C | IC | IC | IC |
| L22 | C | IC | IC | IC |
| L23 | IC | IC | IC | IC |
| L24 | C | IC | IC | IC |

| | 1.1 | 1.2 | 2.1 | 2.2 |
|-----|------------|------------|------------|------------|
| L25 | C | IC | IC | IC |
| L26 | C | IC | C | C |
| L27 | PC | IC | IC | IC |
| L28 | IC | IC | C | IC |
| L29 | C | IC | IC | C |
| L30 | C | IC | C | IC |
| L30 | C | IC | C | IC |
| L31 | C | IC | IC | IC |
| L32 | C | IC | IC | IC |
| L33 | PC | PC | IC | IC |
| L34 | IC | PC | IC | IC |
| L35 | PC | IC | IC | IC |
| L36 | PC | IC | IC | IC |
| L37 | PC | IC | IC | IC |
| L38 | C | IC | IC | IC |
| L39 | PC | IC | IC | IC |
| L40 | PC | IC | IC | IC |

Table 3 shows the percentages of correct/incorrect learner solutions per question. To get a clear-cut success rate per question, PC was incorporated with the IC to give the total number of incorrect solutions per question in Table 2. The PC category showed that learners had an idea about the fraction problem though they deviated from the ideal solution due to potential misconceptions or arithmetic challenges.

Table 3

Percentages of correct/Incorrect learner solutions per question.

| Question | Number of correct solutions | Correct solutions in terms of % | Number of incorrect solutions | Incorrect solutions in terms of % |
|-----------------|------------------------------------|--|--------------------------------------|--|
| 1.1 | 17 | 43% | 23 | 57% |
| 1.2 | 0 | 0% | 40 | 100% |
| 2.1 | 5 | 13% | 35 | 87% |
| 2.2 | 2 | 6% | 38 | 94% |

Looking at Table 3, the solutions from learners are so depressing. The table reflects poor performance in almost all questions. It is also evident that it is likely that most of the learners had no understanding of the concept of multiplication and division of fractions. This resonates with Bruce et al. (2014) when saying the application of algorithms in multiplication and division of fractions contributes to the procedural learning of the concepts.

Table 4's performance indicators may be attesting to this. Most learners did not do well with the multiplication and division operations of fractions. Tables 2 and 3; however, do not show how the learners solved the problems. Although Table 3 presents the most common incorrect learner solutions, it does not cater for learner explanations (which were part of the interview process) including how they obtained correct solutions, hence Table 4 has been introduced to show most common incorrect learner solutions (misconceptions) and the corresponding frequencies

Table 4: Most common incorrect learner solutions (misconceptions) and the corresponding frequencies.

| Question | Misconception | Frequency | % | Misconceptions | Frequency | % |
|----------|--|-----------|----|--|-----------|----|
| 1.1 | $\frac{1}{2} \times \frac{1}{3}$ $\frac{1 \times 3}{2 \times 3} + \frac{1 \times 2}{3 \times 2} = \frac{5}{6}$ | 12 | 30 | | | |
| | Explanation: 30% of the learners take finding the common denominator as the first step (regardless of the operator) when dealing with fractions with different denominators. | | | | | |
| 1.2 | $2\frac{1}{2} \times 3\frac{1}{5} = 6\frac{1}{10}$ | 13 | 33 | $2\frac{1}{2} \times 3\frac{1}{5} = 6\frac{2}{10}$ | 6 | 15 |
| | Explanation: 48% of learners believed that whole numbers are multiplied separately from fractional parts before combining the two answers. | | | | | |
| 2.1 | $8 \div \frac{1}{2} = 4$ | 15 | 38 | $8 \div \frac{1}{2} = \frac{1}{4}$ | 6 | 15 |
| | Explanation: 38% of learners perceived dividing by half as getting half of the quantity. 6 learners however divided guided by the whole number division that two goes into eight, four times. The position of the two in the question (denominator) influenced the positioning of the four in the solution $\frac{1}{4}$. | | | | | |
| 2.2 | $\frac{1}{2} \div 10 = 5$ | 9 | 23 | $\frac{1}{2} \div 10 = \frac{1}{5}$ | 5 | 13 |
| | Explanation: 23% of learners calculated half of ten whereas 5 learners divided ten by two to get 5 which they reciprocated to maintain the denominator status 2 initially had. | | | | | |

The discussion, which follows, is an analysis of how selected learners responded to each of the questions in the test and during the interview. The researchers interviewed eight learners, and the data obtained revealed similarities. The researchers, therefore, decided to use data from four learners because the data from eight learners would have reflected too many repetitions.

To report on much of the relevant information from all the interviews, the researchers will report on any four of the eight interviewed learners per question. The interviewed learners are L6, L11, L15, and L17. For each question, any four of these will be referred to without implying through the labelling the order in which they were interviewed. The interviewer will be represented as the “interviewer (I)” in the transcript.

Question 1

Q 1.1 Use any strategies to find answers to the following:

$$\frac{1}{2} \times \frac{1}{3}$$

This question focused on the multiplication of common fractions. Table 1 shows that 42,5% of the learners got it right, 27, 5% were partially correct and 30% of the learners were incorrect. Table 3 shows that the most common anomaly was finding the common denominator when multiplying fractions. Thirty per cent (30%) of learners used this strategy. The use of cross manipulations with fractions might be leading learners to just apply the manipulations without proper conceptual reasons underlying their actions (Aksoy & Yazlik 2017). L11 arrived as shown in figure 3:

3 - 1 = 2

$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Figure 3: L11's answer to Question 1.1

L11 also had his efforts directed to working with a common denominator and had the following to say:

L11: Denominators are different so my teacher encouraged us to use the same denominators

L11: I subtracted 1 from 3 so that both fractions have denominator 2

L15 arrived at the solution as shown in figure 4:

3.1 $\frac{1}{2} \times \frac{1}{3}$

$$= \frac{1 \times 1}{2 \times 3} = \frac{1}{6}$$

$\frac{1}{3} \times \frac{2}{3} = \frac{2}{9}$

$$= \frac{1}{6} + \frac{2}{9}$$

$$= \frac{5}{18}$$

Figure 4: L15's answer to Question 1.1

L15 used a similar approach to that used by L38 although with a variation in that addition and multiplication were both used. L15, when asked about the procedure used, had the following to say:

L15: I first found the common denominator and made the fractions have the same denominator

I: Why did you find the common denominator?

L15: So that I can add easily the two fractions.

I: It's multiplication, how come you talk of addition now?

L15: With fractions, addition and multiplication work together.

L38 added values diagonally supporting the step by stating that when it is multiplication, the easier and faster way is to add. This misconception can be attributed to utilising an algorithm for a particular topic in a concept where it is irrelevant. Multiplication may be taken as repeated addition (Aksoy & Yazlik 2017), but in this case, L11, and L15 over-elaborated the common denominator aspect of fractions as they decided to work with common denominators even on the multiplication of fractions. However, the inadequate conceptualisation of the multiplication of fractions led to mathematically incorrect manipulations. Determining the common denominator proved a challenge for learners, thereby displaying weak conceptions of equivalent fractions knowledge. Learners in this study, however, did not use the area model of multiplication which Tsankove and Pjanic (2009) regard as an effective way of linking the multiplication of fractions to the whole number multiplication

Q 1.2 Use any strategies to find answers to the following:

$$2\frac{1}{2} \times 3\frac{1}{5}.$$

This question focused on the multiplication of mixed fractions. This resulted in no correct and 100% incorrect solutions by the learners. The learners matched and multiplied the corresponding components of the fractions as if they were multiplying natural numbers. The most common incorrect solution, as shown in Table 4, was $6\frac{1}{10}$. Forty-eight per cent of learners believed that whole numbers are multiplied separately from fractional parts before combining the two answers (Hackenburg & Tillema 2009). Interviews revealed that it was not an attempt at the distributive law but an incorrect assumption that the multiplication operator can be treated the same way as the addition operator when dealing with mixed numbers. Learner L6 had the following to say when asked about the $6\frac{1}{10}$ solution:

L6: $6\frac{1}{10}.$

I: *Please explain how you arrived at your answer.*

L6: *I multiplied whole numbers alone $2 \times 3 = 6$ and fractions separately $\frac{1}{2} \times \frac{1}{5} = \frac{1}{10}$ hence combined answer of $6\frac{1}{10}$.*

I: *Why do you separate wholes from fractional parts as you carry out your calculations?*

L6: *Whole numbers can be treated separately in fractions and fractions as well.*

I: *Do you separate wholes in some operations or whether it's addition, subtraction, multiplication or division the same approach works?*

L6: *It works all around, you can add wholes/fractions separately, you can subtract wholes/fractions separately, multiply wholes/fractions like in this case and you can even divide wholes/fractions separately.*

I: *Please give me an example of a real-life situation where the multiplication of fractions is used.*

L6: *Aaah, I don't know.*

L6 believed that the whole number parts of the mixed numbers are multiplied separately and the fractional parts separately also before combining the respective answers to form the product. This misconception may emanate from a similar process which yields correct solutions in the addition of fractions (Aksoy and Yazlik 2017). Learners are likely to commit many errors if they are solving multiplication or division of fractions procedurally without understanding.

Q 2 Use any strategies to find answers to the following

2.1 $8 \div \frac{1}{2}$

This question focused on the division of a whole number by a common fraction. Thirteen per cent (13%) of the learners got it right. Eighty - seven per cent (87%) of learners did not get it right. Table 4 shows that four was the most popular incorrect answer. Thirty-eight per cent (38%) of learner solutions had four as the answer. This might be the effect of the general belief that division makes it smaller. Alternatively, learners might have interpreted the question as to mean halving an eight. The misconception might be a result of inappropriate use of mathematical language informally in daily experiences. L6 had the following to say in justifying a solution of four:

- L6: *Simple, $\frac{1}{2}$ of 8 is 4.*
- L6: *Off course, $8 \div \frac{1}{2}$ means half of 8.*
- I: *Please explain your calculation.*
- L6: *When you have 8 blocks, and you divide making it smaller you cut at the centre you get four-four.*
- I: *Why cut at the centre?*
- L6: *Yes, divide by half means have two parts, half-half*

L11 provided the same answer through an attempt of applying the invert and multiply algorithm. L11 justified the steps taken as follows:

- L11: $\frac{8}{1} \times \frac{1}{2} = \frac{8}{2} = 4$
- I: *Please explain your calculation*
- L11: *When dividing fractions, you change the division sign to a multiplication before multiplying normally.*
- I: *Does this mean $8 \div \frac{1}{2}$ is the same as $8 \times \frac{1}{2}$?*
- L11: *For some questions you are lucky they give you times (\times) you do not need to change but for others, you need to change because you would not get the answer right if you do not change \div to \times .*

The learners explained that $8 \div \frac{1}{2}$ means the same thing as $\frac{1}{2}$ of 8. L6 and L11 clarified in such a way that they ended up concluding that dividing by two is the same as dividing by $\frac{1}{2}$. This misconception may be a result of the interpretation of divide by half to mean divide into two equal parts, which in essence implies divide by two. Learners use the two interchangeably in everyday life. L6 pointed out that, informally, they use divide by half more often than divide by two when instructing two individuals to share equally. Since the final answer four is less than eight, the sensibility of the solution might have been strengthened by the misconception that division results in a smaller value.

L11 had a vague idea of changing division to multiplication. The learner declared that the \div has to be changed to \times because at times you get remainders when you divide across. If you multiply, however, the learner continued, you will never get a remainder so we must always change to multiplication. Maybe due to rote learning, the learner just changed the operator (\div) to (\times) without inverting the second fraction. Some learners in this study were doing cross multiplication, multiplying the numerator of the first fraction by the denominator of the second, and then the denominator of the first fraction by the numerator of the second. The development of such mathematically incorrect methods exemplifies what Ojose (2015) terms “naïve theory development”, which impedes rational reasoning and results in misconception synthesis. According to Brown and Quinn (2007), this results from the over generalisation of a cross-multiplication algorithm and can be eliminated by guiding learners to develop the formula $a/d.b/c=(a.b)/(d.c)$. Thirty per cent (30%) of the learners had to find the lowest common multiple or common denominator first before attempting to multiply

Q 2.2 Use any strategies to find answers to the following

$$\frac{1}{2} \div 10$$

This question focused on the division of a common fraction by a whole number. Six per cent (6%) of the learners got it correct. Of the ninety-four (94%) incorrect answers, Table 4

shows that five was the most prevalent answer. Twenty-three per cent (23%) of the learners had “five” as the solution. The learners might have expected an answer smaller than ten, generalising from the natural number perspective that division makes smaller. Learner L34 had the following to say as a justification for getting the answer of five.

An attempt to invert and multiply is evidenced in the following conversation with L6:

- L6: $\frac{1}{2} \div 10 = 20$.
- I: *Please guide me on how you got your answer*
- L6: *I converted $\frac{1}{2}$ to $\frac{2}{1}$ so that the sign changes to \times . $\frac{2}{1} \times 10 = 20$.*
- I: *Do you know why inverting and changing to multiplication works?*
- L6: *I know that it makes working with a division of fractions simple.*
- I: *In what way? Please elaborate.*
- L6: *My teacher said it is not always easy to divide some numbers so co...converting a fraction makes it multiplication and you can multiply easy numbers.*
- I: *Do you think you can use this question to clarify what you mean?*
- L6: *Yes Sir, for $\frac{1}{2} \div 10$ I cannot easily get the answer to $1 \div 10$ but when I put it upside down and multiply it, it becomes very simple. $\frac{2}{1} \times 10 = 20$.*

From a different approach, L15 also got five and clarified the steps taken in the following manner:

- L15: $\frac{1}{2} \div \frac{10}{1} = \frac{10}{2} = 5$.
- I: *Please get me through your work.*
- L15: *I changed 10 to $\frac{10}{1}$ so that it does not confuse me.*
- I: *Explain further to illustrate how this helped you avoid confusion.*
- L15: *It is clear now as numerators will divide each other, and denominators divide each other also.*
- I: *Alright I get you, now the problem looks $\frac{1}{2} \div \frac{10}{1}$, continue then.*
- L15: $\frac{1 \div 10 = 10}{2 \div 1 = 2}$ so, it leads to $\frac{10}{2}$ and 10 divided by 2 is 5.

Responses to Questions 2.1 and 2.2 were similar. In justifying their solutions, the learners believed that $\frac{1}{2} \div 10$ is the same as $10 \div \frac{1}{2}$ and that both translated to $\frac{1}{2}$ of 10. Learner 15 insisted on changing \div to \times without inverting the second fraction. This cemented the misconception by the learner that $\frac{1}{2} \div 10$ is indeed equal to $10 \div \frac{1}{2}$. In reality $\frac{1}{2} \times 10$ and $10 \times \frac{1}{2}$ are the same because of the commutative property, which however does not apply to division. L6, for example, said, “when you have 8 blocks and you cut at the centre you get four-four”. L6 divided in half. This translates to eight blocks considered as a unit (whole) divided at the centre, not eight separate blocks (eight wholes) or discrete objects, each block divided at the centre. This misconception also draws from centralising work on fractions to one whole. The answer may seem to make sense considering what Olanoff (2011) states; that with division learners think the result of the problem should be less than the input so the tendency is to work towards achieving that. Graeber and Tirosh (1990) had a similar view about the learner notion that multiplication always results in a bigger number and division leads to a smaller number.

The results show that the students have conceptual barriers and misleading ideas in learning multiplication and division of fractions. Many students are using algorithms and rules without understanding them. Such a formula-based approach to learning practical concepts such as multiplication and division does not allow the students to appreciate mathematics as a human activity. The memorisation of procedures without understanding leads to students applying rules of addition in the multiplication context in responding to question 1.1 (e.g., finding LCM) and in question 1.2 (e.g., Multiplying wholes together and parts together). The results of the study agree with the finding of Graebe and Tirosh (1990) that students conceptualise multiplication as making the number bigger and subtraction as making the number smaller. This is evident when eighty-seven percent of students found got question 2.1 ($8 \div \frac{1}{2}$) wrong, and many got the answer as a number below eight because of the misconception that division results in the number being smaller.

Conclusion and Recommendations

The analysis of the findings of the study indicates that learners have misconceptions when dealing with multiplication and division of fractions. Conceptual misunderstandings coupled with whole number knowledge extension onto fractions contributed to several misconceptions identified in this study. The study showed that a procedural approach was adopted by learners as they dealt with the multiplication and division of fractions. The study revealed that learners “blindly” followed steps they did not understand and hence were prone to mistakes. We suggest that educators must avoid rote learning, as learners might memorise and forget in the long run. The educator must encourage learners to develop meaning while solving multiplication and division problems. Educators should consider using concrete objects when introducing the concept of multiplication and division and engage learners in hands-on activities (Moloi & Matabane, 2020). The invert and multiply approach to the division has to be derived inductively. Learners must use the long way for some activities before they are guided to discover that inverting the second fraction and multiplying yields the same answer. Utilising a variety of strategies during instruction is encouraged as this appeal to numerous learning styles held by different learners. Multiplication and division of fraction strategies should be explored so that learners know with ease what strategy best suits a particular problem. We encourage educators to maximise the conceptualisation of multiplication and division of fractions by teaching for understanding.

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PERFORMANCE EVALUATION OF TEACHERS AS A CORRELATE OF INSTRUCTIONAL EFFECTIVENESS AND STUDENTS' ACADEMIC ACHIEVEMENT IN BASIC SCIENCE

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Abstract

This study determined the relationship between performance evaluation of Basic Science teachers and their instructional effectiveness as well as the academic achievement of students in Basic Science Basic Education Certificate Examination (BECE). Correlation survey research design was employed for the study using a sample of 558 respondents comprising 58 Basic Science teachers and 500 students. Three instruments, namely Students' Basic Science Teachers Performance Evaluation Rating Scale (SBSTPERS), Basic Science Teachers Instructional Effectiveness Questionnaire (BSTIEQ) and Students' Academic Achievement Proforma (SAAP)", were developed by the researchers and used to collect the data. The instruments were validated by three experts, reliability coefficients for the six clusters of the SBSTPERS were estimated as 0.83, 0.85, 0.80, 0.87, 0.86 and 0.81, with overall reliability index of 0.88, while the reliability coefficient for the BSTIEQ was 0.83 using Cronbach Alpha method. Linear regression was used to answer research questions as well as test the null hypotheses at 0.05 level of significance. The findings of the study among others revealed that 33% of teachers' instructional effectiveness is accounted for by teacher's performance evaluation. The result also revealed that 28% of students' academic achievement is accounted for by teachers' performance evaluation. Thus, the researchers recommend that the ministry of Education should organize workshops and seminars for Basic science teachers to sensitize them on the relationship between their performance evaluation and their instructional effectiveness.

Keywords: Performance Evaluation; Instructional Effectiveness; Achievement in Basic Science.

Introduction

The advancement and development of nations depend heavily on science. There is widespread agreement that science is important to people and society as a whole and is a crucial tool for societal development (Baroody, 2017). In order to build a strong foundation of technologically oriented people in line with the requirements of national development efforts, the Federal Republic of Nigeria (2014) pushed for improvements in the teaching and learning of Science, Technology, and Mathematics (STM). As a result, knowledge of science becomes more crucial for everyone's well-being as well as for society at large. Due to the significance of science to a country's progress, Basic Science was incorporated into the Nigerian education curriculum.

Formerly known as Integrated Science, Basic Science and Technology was given a new name in 2007 as a result of curricular changes made by the Nigerian Educational Research and Development Council (NERDC), which enables students to understand the underlying unity of science. The study of both living and non-living things is the focus of basic science and technology, which unifies other scientific disciplines. It establishes the groundwork for the study of pure science disciplines at the senior secondary school and tertiary education levels in subjects such as Physics, Chemistry, and Biology. Mathematical knowledge was

included in the Basic Science field by Sharad (2009). The fundamental tenet of Basic Science ensures knowledge of natural events. In order to be abreast with these events, one seeks knowledge and the finding of facts.

Basic Science, the Bedrock of Sciences

In order to attract students' interest in science at an early age, Basic Science is taught in the primary grades. As a follow-up, Basic Science is taught at the upper elementary education level to help students expand and concretize the science knowledge they had in primary school and to lay the groundwork for the study of the core science subjects, such as Physics, Chemistry, and Biology, in senior secondary education. Because it places emphasis on the fundamental unity of scientific thinking, basic science is the cornerstone of science education in Nigeria (Maduabum, 2011). Every kid should be introduced to the fundamental knowledge and understanding of what Basic Science is all about. They are to be exposed to some of the innovations that are happening all around them through the teaching of Basic Science at the elementary education level. This claim fits with the goals of learning science at the primary education level, which are to produce learners who can function well in the modern era of science and technology and contribute to the growth of the country (FRN, 2014).

At upper basic education level, students acquire from basic science, the initial theoretical and practical foundations necessary for future study of core science subjects. Ekundayo (2012), is of the opinion that students may understand science concepts, principles, theories, and laws that are further investigated in core sciences, supports this claim. According to Jirgba (2008), teaching basic science exposes kids to scientific pursuits. Because of this, the Federal Republic of Nigeria (FRN) emphasizes in its National Policy on Education that science and technology are the cornerstones of the country's socioeconomic liberation and integration into the dominant global scientific and technology culture (FRN, 2013). Children should be exposed to the fundamentals of science and technology, according to Ogunjobi (2016). The goal of basic science is to help the child develop specific science process skills, such as observing, organizing information learned, generalizing on the basis of that knowledge, making predictions as a result of generalizations, and creating experiments to test predictions (FRN, 2013).

The richness, appropriateness, and interrelationship of the curriculum's elements can be seen in the basic science curriculum. The curriculum's goals for higher basic education levels are to encourage students to pursue the sciences, help them learn the fundamentals of science and technology, and help them put their knowledge to use. Additionally, the program prepares students to pursue science and technology coursework (Federal Ministry of Education, 2009). The correct teaching of basic science is necessary to advance students' comprehension and raise their academic performance in senior secondary school's core science subjects. Therefore, a student's performance in basic science will have a significant impact on how well they perform in each of the main science subjects that they take in senior secondary school. This is because science is taught as Physics, Chemistry, and Biology at the senior secondary education level in Nigeria.

Basic Science and Academic Achievement

Even though basic science is acknowledged as a cornerstone subject for the key science disciplines (chemistry, physics, and biology), students' low levels of achievement in these subjects are concerning. In the Basic Education Certificate Examination (BECE) for Basic Science and Technology from 2015 to 2019, the percentage of students passing with credit was 22.86%, 56.44%, 21.06%, 13.69%, and 23.82%, respectively (Enugu State Ministry of Education, 2020). The outcome would be detrimental to students who intend to pursue science courses at higher academic levels since they will have required to quit science in

favor of non-science subjects. This, in the future, would not be of any advantage to either the students or the nation.

The report demonstrates students' inconsistent academic achievement. Many of the factors that have contributed to this include: firstly, the use of the lecture method (Adejoke, 2010), which prevents students from actively participating in teaching and learning, leading to passivity and inability to master science skills and abstract thinking (Akinmade, 2011; Anyaegbunam, 2012; Mbanefo, 2015; Ezugwu, 2021). Secondly, teachers who are inadequately prepared to teach the students with appropriate instructional methods (Mbanefo, 2015); and lastly, poor teaching methods. According to Ezugwu (2021), educators can consider more effective strategies for piqueing students' interest at that point in their education by incorporating enthusiasm into the teaching and learning process.

Despite these efforts, there hasn't been any discernible improvement in students' academic performance in Basic Science and Technology in recent years. Peer tutoring was suggested as a solution for students to help improve this troubling situation, even though Sani and Nsorfor's (2013) study found that underachievement is a result of several issues related to students, schools, and families. The purpose of this study was to assess the school-related variables that influence students' academic progress, such as the efficacy of teachers' instruction. The degree to which a teacher can bring about the desired change in a student's academic performance is known as instructional effectiveness (Clayson, 2011). This drive ought to improve students' conceptual understanding and problem-solving abilities in the subject, which should improve their academic performance. According to Erick (2013), effective teaching strategies involve all types of students. Successful teaching strategies include differentiated education; which involves the process of teaching and learning for students of differing abilities in the same class and mixed methods education; which involves both qualitative and quantitative approach in teaching and learning.

Successful teachers have various exceptional traits. According to Wongs and Harry (2017), have three traits which are good classroom management techniques, curriculum mastery, and high expectations of their students. The following performance evaluation techniques can be used to evaluate teachers' instructional effectiveness: classroom observations, value-added models, portfolios, self-reports of practice, student ratings, or surveys, among others (Goe, 2018). Depending on the objective or method chosen, these evaluation procedures may be used by the inspectorate/supervisory division of the federal ministry of education, the state ministry of education, the supervisory principals at zonal offices, the schools monitoring team of School Based Management Committees (SBMC), or even the students. Most of these assessment techniques are always used for summative, formative, or both types of evaluation. Summative evaluations are used to assess career advancement, potential positions for promotion or demotion, and termination while formative evaluation focuses on improving performance, including career growth, professional learning, and feedback. The best quality assurance mechanism may be performance evaluation that detects and improves teaching quality when utilized for both accountability and instructional improvement (Danielson & McGreal, 2010). Due to the focus that the federal, state, and local governments have placed on school- and classroom-level accountability of learning, performance evaluation of teachers' efficacy has altered along with a new understanding of what constitutes good teaching. As definitions and views about what should be measured have changed, so have the metrics used to assess teachers' efficacy. The responsibility for classroom teaching and learning is now placed on the teachers. It is believed that effective instruction is crucial and is the primary school-based element influencing students' academic success (Darling Hammond, 2010). Because of the disagreement about what and how to measure a good teacher, evaluating teachers' effectiveness has remained a challenge.

Teacher Performance Evaluation

Examining a teacher's performance while on the job, including what they do in the classroom and how much improvement the students make on achievement tests, is the greatest approach to judge how effective their instruction is. A classroom observation/clinical supervision is a frequently used performance evaluation in secondary schools in Enugu State. It is intended to assess teachers' performance in relation to standards of effective teaching (punctuality, classroom management, and record keeping source: PPSMB 2017/18 session). Because of the location of the school, the administrative backlog, the lack of adequate logistics, and the shortage of human resources, these evaluations often happened in a haphazard manner such that did it not involve all the teachers in the zone. Unfortunately, the requirements for performance review can induce anxiety and worry in teachers who submit themselves for evaluation because of how the evaluation outcomes might influence them (teachers).

Finding areas for growth for individual teachers and developing individual improvement plans (including professional development) that consider the entire school development plan are two primary goals of teacher performance evaluation. Additionally, career development, performance rewards, and sanctions for underperforming teachers can all be decided upon based on an evaluation of the teachers' performance. It provides a chance to acknowledge and reward teaching performance and competency, which is crucial for keeping competent teachers in classrooms and for making teaching a desirable career choice (Organization for Economic Cooperation Development, 2005)

Because they interact with instructors the most, and are the direct recipients of their services, students' perceptions of teachers should be a key factor in any system of teacher assessment. Given their interactions with teachers in the classroom, it's possible that students' evaluations or ratings of teachers' performance in formative and summative evaluations will yield useful information. In a study conducted by Madu and Kukwui (2012), it was hypothesized that while students appreciate teachers for their warm, approachable, and humorous demeanor in the classroom, they will be openly critical of them if a subject like mathematics is poorly organized, or the teaching methods are not engaging enough. This indicates that the teachers' performance evaluation has fallen short of demonstrating the good effects that a strong teacher evaluation system could have on instructors' ability to deliver effective lessons, which in turn could boost students' academic performance. The stakeholders in education may however be able to develop thorough and practical ways for evaluating teachers' performance. This will help teachers deliver more effective lessons and support students' academic success in basic science. This demonstrates the necessity of the study. The goal of this study was to determine the relationship between instructors' performance evaluations and the academic achievement of students in Basic Science at the BECE. These research questions were posed and answered:

1. What is the relationship between teachers' performance evaluation and their instructional effectiveness?
2. What relationship exists between teachers' performance evaluation and students' academic achievement in Basic Science?

These null hypotheses were tested at 0.05 (α) significance level:

H₀₁: The relationship between teacher's performance evaluation and teachers' instructional effectiveness is not significant.

H₀₂: Teachers' performance evaluation and students' academic achievement in Basic Science have no significant relationship.

Methodology

Correlation survey research design was adopted for the study. Correlation survey research design seeks to establish what relationship, association or co-variation exists between two or more variables. The population for this study is 4615 subjects, made up of 117 Basic science teachers and 4498 JSS3 Basic Science Students in public secondary schools in Nsukka Education zone for 2021 academic session. The sample of the study consists of 558 respondents, comprising 58 Basic Science teachers and 500 JSS3 Basic Science Students, drawn from the population. The sample was drawn using multi-stage sampling procedure.

The researchers developed three instruments titled “Students Basic Science Teachers Performance Evaluation Rating Scale (SBSTPERS)”, “Basic Science Teachers Instructional Effectiveness Questionnaire (BSTIEQ)” and “Students’ Academic Achievement Proforma (SAAP)”. The SBSTPERS have two sections; Section A seeks information on teachers’ biographical data, while Section B is made up of six clusters; Content Knowledge, Instructional Planning, Instructional Delivery, Assessment of Learning, Classroom Management/Learning Environment, and Professionalism/Student Progress and relationship. The instrument has a total of 45 items which the students used to rate the teachers on the extent the teachers discharged their duties. The teachers are rated under these performance skills/variables in four-point scale scored as Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2) and Strongly Disagree (SD = 1). The BSTIEQ constitutes 30 items of teaching skills/behaviour characterizing an effective teacher. The response options on four-point scale, scored as Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2) and Strongly Disagree (SD = 1). The instrument enabled the researchers to collect data on teachers’ instructional effectiveness. Finally, the SAAP contains the name of the schools, serial number, students’ registration number and students’ academic achievement score in Basic Science BECE.

Three experts from the Department of Science Education, University of Nigeria, subjected the instruments to face validation. The SBSTPERS and BSTIEQ instruments were trial tested on equivalent groups of 20 and 30 Basic Science teachers and Basic Science students respectively. The internal consistencies of the instruments were established using Cronbach Alpha reliability method. The reliability coefficients for the six clusters of the SBSTPERS are 0.83, 0.85, 0.80, 0.87, 0.86 and 0.81, with overall internal consistency reliability index of 0.88. However, the reliability coefficient for the BSTIEQ is 0.83. This shows that the instruments are reliable and adequate for the study.

The researchers visited each of the schools that were selected for the study. Such visits facilitated the process of data collection because it availed the researchers opportunity to make contacts with the school authorities, especially the principals and the form teachers of the students, who provided information about the students. After, the researchers, with the help of three research assistants administered the SBSTPERS and BSTIEQ to students and teachers, respectively. The respondents returned the responses immediately after completion. Meanwhile, with the permission of the Chairman of Education Development Centre Enugu, students’ achievement scores in Basic Science for the 2021/2022 BECE were obtained using the Proforma. Linear regression analysis was used to answer the research questions as well as test the null hypotheses at 0.05 level of significance.

Results

Research Question One: What is the relationship between teachers’ performance evaluation and their instructional effectiveness?

Table 1

Regression analysis of the relationship between teachers' performance evaluation and their instructional effectiveness

| Model | n | R | R Square | Adjusted R Square | Std. Error of the Estimation |
|-------|-----|-------------------|----------|-------------------|------------------------------|
| 1 | 500 | .573 ^a | .329 | .327 | 4.54811 |

a. Predictors: (Constant), SBSTPERS

Analysis in Table 1 shows that the correlation coefficient (r) of 0.573 was obtained for the relationship between teachers' performance evaluation and their instructional effectiveness. The result also shows that there is a moderate positive relationship between teachers' performance evaluation and their instructional effectiveness. A coefficient of determination (r^2) of 0.329 was obtained, which means that 33% of teachers' instructional effectiveness is accounted for by teachers' performance evaluation.

H₀₁: The relationship between teacher's performance evaluation and teachers' instructional effectiveness is not significant.

Table 2

Regression ANOVA output on the relationship between teacher's performance evaluation and teachers' instructional effectiveness

| Model | Sum of Squares | Df | Mean Square | F | Sig. |
|--------------|----------------|-----|-------------|---------|-------------------|
| 1 Regression | 5043.462 | 1 | 5043.462 | 243.818 | .000 ^b |
| Residual | 10301.296 | 498 | 20.685 | | |
| Total | 15344.758 | 499 | | | |

a. Dependent Variable: BSTIEQ

b. Predictors: (Constant), SBSTPERS

Table 2 revealed a significant positive relationship between teacher's performance evaluation and teachers' instructional effectiveness, $F(1, 498) = 243.818, p = .000$.

Research Question Two: What is the relationship between teachers' performance evaluation and students' academic achievement in Basic Science?

Table 3

Regression analysis of the relationship between teachers' performance evaluation and students' academic achievement in Basic Science

| Model | n | R | R Square | Adjusted R Square | Std. Error of the Estimation |
|-------|-----|-------------------|----------|-------------------|------------------------------|
| 1 | 500 | .525 ^a | .275 | .274 | 5.03814 |

a. Predictors: (Constant), SBSTPERS

Analysis in Table 3 shows that the correlation coefficient (r) of 0.525 was obtained for the relationship between teachers' performance evaluation and students' academic achievement in Basic Science. The result also shows that there is a moderate positive relationship between teachers' performance evaluation and students' academic achievement in Basic Science. A coefficient of determination (r^2) of 0.275 was obtained, which means that 28% of students' academic achievement is accounted for by teachers' performance evaluation.

H₀₂: Teachers' performance evaluation and students' academic achievement in Basic Science have no significant relationship.

Table 4

Regression ANOVA output on the relationship between Teachers' performance evaluation and students' academic achievement in Basic Science

| | Model | Sum of Squares | Df | Mean Square | F | Sig. |
|---|------------|----------------|-----|-------------|---------|-------------------|
| 1 | Regression | 4798.804 | 1 | 4798.804 | 189.057 | .000 ^b |
| | Residual | 12640.658 | 498 | 25.383 | | |
| | Total | 17439.462 | 499 | | | |

a. Dependent Variable: SAAP

b. Predictors: (Constant), SBSTPERS

Table 4 showed there is a significant positive relationship between teacher's performance evaluation and students' academic achievement in Basic Science, $F(1, 498) = 189.057$, $p = 0.000$.

Discussion

The findings indicate a positive relationship of 33% between teachers' performance evaluation and instructional effectiveness. It showed that teachers' performance evaluation has relationship with teachers' instructional effectiveness. The finding of this study is consistent with the findings of Olabanji and Temitope (2015) who reported that teachers' teaching experience significantly influence students' academic performance in Mathematics and English Language. The result also agrees with the findings of Okeke (2008) whose findings revealed that teachers' competence and instructional performance impacted positively on the academic achievement of secondary school students. This implies that teachers' performance evaluation is a significant predictor of teachers' instructional effectiveness.

Findings indicate a positive relationship of 28% between teachers' performance evaluation and students' academic achievement in Basic Science. Findings also revealed that there was a statistically significant relationship between teachers' performance evaluation and students' academic achievement in Basic Science. The findings of this study corroborate with the findings of Uwadoka (2012) which indicated among other things, that teachers' performance appraisal enhanced the academic achievement of students in English Language in Anambra state, Nigeria. The result is also in line with the findings of Ugwu (2009) who reported that teachers' performance assessment enhanced academic achievement of secondary school students in Udi Education zone of Enugu state, Nigeria. The probable explanation of this is that teachers' performance evaluation has proven to be a good predictor of students' academic achievement.

Conclusion

On the strength of the findings of this study, the following conclusions were drawn: 61% of teachers' instructional effectiveness is predicted by teachers' performance evaluation while 57% of students' academic achievement in Basic Science is predicted by teachers' performance evaluation. The finding also shows that teachers' gender is a significant predictor of the relationship between teachers' performance evaluation and teachers' instructional effectiveness. There was a statistically significant relationship between teachers' performance evaluation and teachers' instructional effectiveness. Finally, there was a statistically significant relationship between teachers' performance evaluation and students' academic achievement in Basic Science.

Recommendations

It is recommended therefore that; the Ministry of Education should organize workshops and seminars for supervisory principals, school principals and Basic Science teachers on ways of determining and demonstrating successful approaches, teachers' performance evaluation could improve their instructional effectiveness, thus enhancing students' interest in learning and solving problems, for higher academic achievement in Basic Science. There should be a training/retraining of the supervisors and the teachers, to embrace modern instructional effectiveness approaches that have proved successful in some areas, especially in the teaching and learning of Basic Science. Finally, Ministries of Education and education stakeholders should try to identify the problems of the current practices of teachers in terms of their performance evaluation and create an opportunity to update the general and clinical evaluation guidelines; thus, will go a long way in improving teachers' instructional effectiveness and students' academic achievement. It is also recommended that future research be carried out on the current practices on teachers' performance evaluation, so as to provide realistic stratagems to improving their performance and effectiveness.

Limitation of the Study

In spite of the fact that the study has made many interesting revelations, its completion was faced with some challenges; Some Basic science and Technology teachers were reluctant and unwilling to present themselves for performance evaluation exercise: it then took the researchers ample time to convince such teachers before they agreed to participate.

Another limitation is that some schools do not keep updated records of students' academic performance, which made the researchers work extra hard to get meaningful information regarding students' performance. Also, the roads leading to some of the schools are not motorable, therefore the researchers resorted to trekking at extreme situations where cars and motorcycles could not apply for data collection.

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INFLUENCE OF EARLY SCHOOLING ON SOCIAL BEHAVIOR OF SECONDARY SCHOOL STUDENTS IN DELTA STATE, NIGERIA: INTERVENTION FOR COUNSELLING

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Abstract

The Universal Basic Education (UBE) Act of 2004, placed early child care and education (ECCE) into the mainstream of Education in Nigeria. Since then, several efforts have been made for the education of children to begin at an earlier age. Parents push their children into school at a very tender age and place high expectations on them. The children have to live up to the expectation of their parents and societal demands. With so much pressure on them, they resort to poor social behavior such as substance use and cheating in examinations. This paper investigated the influence of early schooling on poor social behavior among adolescent students in secondary schools in Delta state Nigeria. Descriptive survey research design was used for the study. The population of the study was 14,479 senior secondary school two students. The sample was 1300 early and typical students. Instrument for data collection was a substance use inventory questionnaire (SUIQ) and examination malpractice questionnaire (EMQ). These instruments have Cronbach alpha reliability coefficient of 0.77 and 0.67 alpha level. Two research questions were raised and answered. Data was analyzed using percentages. Findings from the study indicated a high degree of poor social behavior of early entrants of students to secondary schooling in substance use abuse and examination malpractice. Based on this, the study recommended that students should be made to start secondary schooling from the ages of 11years, 5 years for primary school and 3-5 years for pre-school.

Keywords: Early schooling, burnout, poor social behavior, examination malpractice, substance use.

Introduction

Formal education through schooling prepares the individual with the skill to survive in his or her immediate environment and to contribute to national growth and development. This is done taking into consideration the maturational level of the individual. Ugoma, et al. (2019), strongly asserted that the education of the child is a process that draws out the best in the child with the aim of producing well- balanced personality, culturally refined, emotionally stable, ethically sound, mentally alert, morally upright, physically strong, socially efficient, vocationally self-sufficient and internationally liberal.

The year 1999 in Nigeria, the Universal Basic Education was launched, and the UBE Act of 2004 placed early child care and education (ECCE) into the mainstream of education in Nigeria. Since then, several efforts have been made for the education of children to begin at an earlier age. Parents in Nigeria, especially in Delta State, are rushing their children to school despite their tender age.

Early schooling in view of this paper, is the formal education available to children between 1-2 years of nursery school, 3-4 years of primary school and 8-9 years of secondary school. This means that by 3-4 years, the child who started nursery school has completed it. And the child who started primary school by 3-4 years will have completed it between 8-9 years and proceeds into secondary school between 8-9 years. In many cases in Delta State,

the primary 6 class is almost phased out. The trend is that the child passes to primary five class and is admitted into the secondary school, (Ovie, 2022).

This early schooling is very different from the normal early child care and education (ECCE), stipulated by Nigeria Education Research and Development Council (NERDC) in 2014. According to this policy, pre-primary education is the one-year education given to children at ages 5 years, prior to their entering primary school. The purpose of this early child exposure to schooling among others, shall be to inculcate in the child the spirit of enquiring and creating through exploring nature, the environment, art, music and playing with toys, develop a sense of cooperation and team spirit, and teach the rudiments of letters, colors, shape, and form through play.

On the other hand, primary education as referred to in this paper, is the education given in institutions for children 6-12 years plus. This being the case, the goals of primary education are to inculcate literacy and numerical and the ability to communicate effectively, and lay a sound basis for scientific and reflective thinking. While secondary education is the education children receive after primary education and before the tertiary stage with the broad goals of useful living within society and higher education. On this account, the secondary education shall be of six years duration given in two stages: a junior secondary stage and a senior secondary stage.

Jean Piaget propounded a cognitive development theory in 1936 and outlined four distinct stages of cognitive development of children where each stage marks a shift in how they think and understand the world in the nature of learning behavior and morality. Pin pointedly, Piaget asserted that at ages 12 years upward, children are capable of concrete and abstract reasoning. This stage is termed formal operation. This is the stage at which children transition from primary to secondary schooling.

A study was carried out in New York by neuroscientists Giedd et al. (2009), using Magnetic Resonance Imaging (MRI), to scan the brain of children and young adolescents in view of their cognitive readiness for schooling and social behavior. Their findings indicated that the prefrontal cortex of the brain undergoes prunings from ages 5 years, 8 years, 16 years and 20 years upwards. Further findings from the study by these researchers showed that early exposure of the prefrontal cortex and the parietal lobe to complex academic activities and social behavior, can be impulsive, unpredictable and risky (Giedd et al., 2009).

Social behavior is the activity of an individual or group of individuals which qualifies, modifies or otherwise alters the act of another individual or societal norms, (Eric et al., 2005). On the other hand, poor social behavior or antisocial behavior, means behaving in ways that purposefully disregard the rights of others and break societal rules and laws. Diagnostic and Statistical Manual (DSM-V-TR), of antisocial behavior (ASB), are children with an inappropriate recurrent pattern of stubborn, hostile and defiant behaviours exhibited mostly by school age children (Eric & David, 2005). According to study.com. (2021), individuals with antisocial behavior are withdrawn from society and are against societal traditions and norms. This is different from being shy or asocial. A shy individual is reserved in a party setting but is not against the norms of society. Also, the asocial individual is a person that is not social (without social) but is not against societal rules and laws. Antisocial or poor social behaviour is against societal rules and laws. Some behaviors that characterize antisocial behavior according to study.com (2021), are theft, vandalism and crime, lying and deceitfulness, violating social norms and rules, drugs and alcohol abuse, and other forms of behavior

Some prominent factors that may influence the development of antisocial behavior, according to the same authors include the school environment, friendship group, social status, and family personality.

Alan et al. (2000), see early schooling as a correlate of antisocial behavior. According to this study, teenagers exposed early to academic training and whose grades are low are more prone and vulnerable to antisocial behavior. Elkind (2010), using a descriptive survey research design carried out a study in West Hartford with High School Students who were early entrants to schooling on antisocial behavior. His findings surprisingly indicated that, 75% of young adolescents who were engaged in schooling early by their parents become burnt-out easily academically, as against 25% who were late or normal entrant to schooling, leading to examination malpractice. Again, the study of Elkind (2010) and Robert et al (1981), on burnout identified five stages of burnout academically as honeymoon stage, fuel shortage stage, crises stage, and hitting the wall stage.

It is the last stage that characterizes antisocial behavior. This is because when young adolescents in schools are having low grades, aware of imaginary audience, that they will no longer gain the support of their parents, they take to antisocial behavior such as cultism, examination malpractice, drugs abuse and alcoholism where they feel they can be supported.

Many studies have been carried out in some states of Nigeria and some Western countries on drug abuse or substance use and other forms of antisocial behavior. Sophia (2017), in Akoko North East of Ondo state of Nigeria, studied students' antisocial behavior on academic performance. In Oyo state, Ojo (2015), studied prevalence of antisocial behavior among students with hearing impairment while Dan (2007), studied the antisocial behaviours of children and parental influence. In Delta State Nigeria, there is a paucity of studies in relation to early schooling on poor social or antisocial behavior among secondary school students. It is based on this, that this paper examined the extent of poor social or antisocial behavior in examination malpractice and substance abuse among secondary school students in Nigeria in order that counseling can be carried out on them.

Purpose of the study

In recent times in Nigeria, particularly Delta State, it is observed by the current study, that there is an increase in antisocial behavior in alcohol abuse, substance use disorder and examination malpractice among schools students. The current study is therefore aimed at finding out the influence of early schooling on poor social or antisocial behaviours in substance use and examination malpractice among secondary school students Delta state, in Nigeria.

Research Questions

1. What is the extent of substance use among early and typical secondary school students in Delta State, in Nigeria?
2. What is the rate of examination malpractice behaviour among early and typical secondary school students in Delta State, in Nigeria?

Methods

The study made use of a descriptive survey design. This is because the study stands to address early schooling on the poor social behavior of secondary school students in Delta State. The population of the study consists of 14,479 senior secondary school students spread across three educational zones in the state. The sample of the study is 1000 early students entrants and 300 late entrants to schooling. Multistage sampling techniques through purposive sampling were used to select two educational zones out of the three zones (Delta North and Delta South). Simple random sampling was used to select 25 secondary schools from the local government areas and 40 students each from the secondary schools. Instruments for data collection were substance use inventory questionnaire (SUIQ) and an examination malpractice questionnaire (EMQ). Cronbach alpha reliability coefficient was

used to determine the internal consistency. Hence the reliability coefficient of 0.77 and 0.67 was obtained for the instruments. Data were analyzed using percentages. The percentage was obtained by the total respondents over the sample of the study, divided by hundred.

Table 1

Results showing the extent of substance use among early and typical students in secondary school

| Questionnaire items In your opinion, indicate the extent to which students in your school use the following types of substances/drugs | Respondents | | | | | |
|--|----------------|-------------------|------------------------|----------------|-----------------------|------------------------|
| | Early Entrant | | | Late Entrant | | |
| | Always n(%) | Sometimes n(%) | No Response n(%) | Always n(%) | Sometime s n(%) | No Response n(%) |
| Tramadol | 700(70%) | 220(22%) | 80(8%) | 150(50%) | 50(17%) | 100(33%) |
| Marijuana | 300(30%) | 400(40%) | 300(30%) | 60(20%) | 120(40%) | 120(40%) |
| Tobacco/smoking | 500(50%) | 400(40%) | 100(10%) | 70(23%) | 35(12%) | 195(65%) |
| Alcohol | 500(50%) | 200(20%) | 300(30%) | 100(33%) | 70(23%) | 130(43%) |
| Codeine | 100(10%) | 400(40%) | 500(50%) | 50(17%) | 100(33%) | 150(50%) |
| Caffeine | 600(60%) | 350(35%) | 50(5%) | 120(40%) | 50(17%) | 130(43%) |

Table 1 above, showed the extent to which students in the secondary schools formed the habit of substance use, especially tramadol, caffeine, alcohol and tobacco. The extent of tramadol use by early entrants was 70%, Caffeine 60%, followed by alcohol 50%, tobacco 50% and marijuana 30%.

When this was compared with that of late entrants, tramadol use was 50%, marijuana was 20%, alcohol 33.3%, tobacco 23.3% and caffeine 40%.

Table 2

Results showing the rate of examination malpractice behavior by early and typical student entrants into secondary school

| Questionnaire items | Respondents | | | | | |
|---|----------------|-----------|----------------|---------------|-----------|----------------|
| | Early Entrants | | | Late Entrants | | |
| By your observations, indicate the rate at which the following behaviors during examinations are carried out by students in your school | Always | Sometimes | No Response | Always | Sometimes | No Response |
| GIRRAFFING (ie, stretching the neck to spy at another student's answers) | 900(90%) | 80(8%) | 20(2%) | 70(23%) | 100(33%) | 130(43%) |
| Writing prepared answers on laps, palms, concealed by the uniform | 400(40%) | 300(30%) | 300(30%) | 100(33%) | 150(50%) | 50(17%) |
| Students contributing money to pay teachers in the school to solve examination questions for them | 600(60%) | 200(20%) | 200(20%) | 150(50%) | 100(33%) | 50(17%) |
| Impersonation. | 300(30%) | 300(30%) | 400(40%) | 60 (20%) | 50(17%) | 190(63%) |

| | | | | | | |
|--|----------|----------|----------|---------|----------|----------|
| Leaving your own school To enroll in miracle centers to Write WAEC and NECO Examinations | 800(80%) | 150(15%) | 50(5%) | 80(27%) | 120(40%) | 100(33%) |
| Carrying prepared answers To the hall unnoticed by The supervisor | 750(75%) | 100(10%) | 150(15%) | 35(12%) | 70(23%) | 195(55%) |
| Downloading Answers from cell Phones. | 600(60%) | 300(30%) | 100(10%) | 87(29%) | 87(29%) | 126(42%) |
| Arranging with Supervisors to write the exams Outside the hall | 650(65%) | 203(20%) | 147(15%) | 60(20%) | 35(12%) | 205(68%) |

The rate at which students' antisocial behaviour on examination malpractice, is shown on Table 2, where 90% of the early entrants depended on others by spying, 65% pay supervisors and invigilators to write the exams for them outside the hall, 60% pay their teachers to write for them, 70% will go to centres termed miracle centres where there are prepared answers and 30% impersonate. When this is compared with the typical student entrants, 70% depended on others for spying, 50% pay their teachers and invigilators to write for them, 26.7% will go centres termed miracle centres where there are prepared answers and 20% impersonate, this is relatively low.

Discussion of Findings

Findings from the study showed that early schooling into secondary education is a precursor to antisocial behavior in substance use disorders and examination malpractice. This is indicated in Table 1, where early entrants into secondary school abused drugs such as tramadol 70%, caffeine 60%, Marijuana 30%, alcohol 50%, tobacco 50% and codeine 33%. On the other hand, late entrants into secondary school abused tramadol at 50%, marijuana at 20%, tobacco at 23.3%, alcohol at 33.3%, codeine at 33.3% and caffeine at 40%. These findings agree with the study of the Neuroscientists, Gield et al (2009), who opined that early exposure of the prefrontal cortex and the parietal lobe of the brain to complex academic training and social activities could be very impulsive, unpredictable and risky. It also agreed with the findings of Elkind (2010), who concluded that adolescents exposed to early schooling become burnout easily academically, leading to antisocial behavior in examination malpractice, drugs abuse and alcohol abuse.

Counselling Intervention

Developmental psychology considers the individual's growth, development and maturity before they are exposed to complex tasks such as academic training. Cognitive development theory by Jean Piaget and others, emphasized maturity before meaningful learning can occur. This is supported by Neuroscientists who scanned the organs of learning and social behavior (prefrontal cortex and parietal lobe) and pointed out that these organs undergo gradual development unto maturity from 5 years, 8 years, and 16 years upwards.

This sequence of developments follows the normal exposure of the child and adolescent to critical tasks such as academic training in school. Below this sequence of development and its exposure to schooling amounts to academic burnout, academic abuse and violence, leading to antisocial behavior referred to in this paper as substances use disorders and examination malpractice. This is unethical and unhealthy for a growing nation like Nigeria.

Based on this, the following recommendations are made

1. Students should be made to start secondary school between the ages of 11-12 years upward, 5-6 years upward into primary school and 3-4 years upward into pre-school and not below these years.

2. Awareness is needed to guide parents to avoid hurrying their tender children through academic training. This campaign can be made through social media, public address systems by the government and counselors who may have direct contact with parents during the process of admissions. And through the publication of this journal article.
3. Private school owners should strictly adhere to the laid down education policy on the specific age brackets children are expected to be before they are admitted into the school.
4. Monitoring of schools by the ministry of education is necessary to ensure that children are not hurried into academic training.
5. Double promotion and jumping from one class to the other in the name of intelligence should be avoided.
6. Investigation on miracle examination centres should be carried out to avoid examination malpractice. This is a dark spot in the educational system of Nigeria.
7. Counselling on substance use by students should be carried out by students in the school system from time to time. So that they can see the dangers of drugs abuse and avoid it immediately
8. Reinforcement through rewards for good behaviors and punishment for deviant behavior of students, should be enforced in the school system
9. And finally, healthy and educative clubs can be formed by the school management where students are encouraged to join. Secret clubs should be prohibited.

Conclusion

Teaching and learning in a formal educational setting, is built upon the maturity of the cognitive, physical, emotional and moral entity of adolescents. This sequence of development follows the normal or typical exposure of the child and adolescent to critical tasks such as academic training in school. Hurrying of underaged children through academic training leads to academic abuse of the child which could also lead to impulsive, unpredictable and risky behavior (Gield, 2009). Such behaviors are drug abuse, alcohol abuse and examination malpractice, found out in this current study. This can affect the entire well-being of the child in society and hinder the scientific and technological growth of the nation. This implies that the child and the adolescent exposed to academic training at the typical age, acquires skills for successful living in the society and contributes meaningfully to the growth and development of his or her nation.

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