SOUTH AFRICA INTERNATIONAL CONFERENCE ON EDUCATION

17 – 19 SEPTEMBER 2018

"Rethinking Teaching and learning in the 21st Century"

SAICEd

South Africa International Conference
on Education

Proceedings

Manhattan Hotel Pretoria, South Africa

Editors

M. M. Dichaba
M. A. O. Sotayo

Advisory Board

Prof A. Mji, Tshwane University of Technology, South Africa

Prof G.O.M. Onwu, University of Pretoria, South Africa

Prof J. O. Uhomoibhi, University of Ulster, Ireland

Dr David Kabugo, Makerere University, Uganda

Dr Olubukola Dada, Kwara State University, Nigeria

Jose Maria del Campo, Technical University of Madrid, Spain

Prof L.D. Mogari, University of South Africa, South Africa

Dr B.B. Chitsamatanga, University of Fort Hare, South Africa

Dr Gladys Charles-Ogan, University of Port Harcourt Nigeria

Dr M. P. Rankhumise, Tshwane University of technology, South Africa

Mr. Jonatan Muzangwa, Great Zimbabwe University, Zimbabwe

Dr F. O. Nkire, Abia State University, Nigeria

Dr E.H.Mbozi, University of Zambia

Dr D. Nwaozuzu, Coventry University, UK

Danbaba Magana Na-Allah, Federal College of Education Gusau, Nigeria

Prof Zephrinus Njoku, University of Nigeria

Prof CE Ochonogor, Cape Peninsula University of Technology

Dr Chrysoula Argyris Dimitriou, Ministry of Education Cyprus

Preface

The challenges faced today by all those working in education are massive. In this 21st century new challenges continually arise as the boundaries of the age of the knowledge economy expand. Those who identify with the vision of the African Academic Research Forum (AARF) know that it is imperative for them to deliberate upon the impact education should have on society and to share their educational experiences with colleagues from Africa and beyond. It is crucial for us to ensure that there is a cross-pollination of ideas and to recognize that by sharing best practice we push the boundaries of knowledge in the interests of learners and students of all ages.

On this basis we selected the theme of this 5th South Africa International Conference on Education (SAICEd) to be: Rethinking teaching and learning in the 21st century. The theme is in recognition of the fact that we need to reconsider our outdated teaching practices in line with the technology-savvy students we encounter in our lecture halls. We will achieve this when there is a greater sharing of successful practices.

The intention of the AARF, through the SAICEd 2017 Conference, is to ensure that Proceedings contains only papers that have gone through a rigorous, blind peer-review process. We can assure all participants that our reviewers are experts in the field of education who would approve only work that reflects international standards. We received a total of 53 long papers for possible presentation and publication from participants in ten countries. The final number of papers accepted was 30. Hence this document contains these 30 long papers that, through the process described here, were accepted.

We are also happy to report that almost all participants submitting abstracts were invited to the conference. We did this because we understand (i) the importance of sharing one's research with others; and (ii) how this allows, especially new researchers, an opportunity to interact with renowned researchers in their field.

The reviewers have worked tirelessly to ensure that the papers presented at this conference are comparable to those at any other conference in the field of education. The esteemed keynote speakers, experts in their respective fields, as well as the workshop presenters, bring their time and expert knowledge to the conference. In sharing their knowledge with our participants they extend the boundaries for all in the interests of education. Finally, we offer a word of appreciation to the technical staff and the editors who have ensured that the book of abstracts and the Proceedings are ready in order for the conference to run smoothly. Their assistance is greatly appreciated.

To everyone, best wishes to you and enjoy the conference.

Prof A. Mji
Conference Chair

List of Reviewers

The organising committee of SAICEd 2018 would like to greatly thank the following reviewers who took the pains to review the conference papers.

Dr Adaobi Ubah	University of KwaZulu – Natal
Dr J. Owusu-Mensah	Vaal University of Technology
Dr Celestin Mayombe	University of KwaZulu-Natal
Dr Selloane Pitikoe	University of KwaZulu-Natal
Danbaba M. Na'Allah	University of the Witwatersrand
Dr Williams Ndlovu	University of South Africa
Dr D.M Hannaway	University of South Africa
Prof T. Mapotse	University of South Africa
Dr Gladys Charles Ogan	University of Port harcourt
Dr JK Alex	Walter Sisulu University
Dr J. Shumba	University of Fort Hare
Ayanda Pamella Msomi	University of South Africa
Dr M.O. Abanikannda	Osun State University
Mzoli Mncanca	University of South Africa
Dr Joyce Mathwasa	University of Fort Hare
Prof Leila Goosen	University of South Africa
Dr O.A Ige	University of the Free State
Dr Ezekiel Afolayan	Federal College of Education, Abeokuta, Nigeria
Dr B.B. Chitsamatanga	University of Fort Hare
Prof Awelani V. Mudau	University of South Africa
Dr Byung-In Seo	Chicago State University, Chicago, Illinois, U.S.A
Prof M Motseke	University of South Africa
Prof Zingiswa Jojo	University of South Africa
Dr Clemence Chikiwa	Rhodes University
Prof L Goosen	University of South Africa
Dr Kimera Moodley	University of Pretoria
Dr Portia Kavai	University of Pretoria
Dr Marien Graham	University of Pretoria
Dr Edward Matabane	University of Pretoria
Dr Caleb Akintade	Federal College of Education, Abeokuta Nigeria
Dr Akin Fatokun	Federal College of Education, Abeokuta Nigeria
Dr Joseph. B. Filani	Federal College of Education, Abeokuta, Nigeria
Dr Ige Bolapade Simi	Federal College of education Abeokuta, Nigeria

Review Process

In total, 105 manuscripts in different areas within the field of Education were received. Of these manuscripts, 53 were intended to be full papers while the rest were to be short papers. All the full manuscripts were subjected to a double blind review. The reviews were carried out by experts from different countries. Their brief was to base their reviews on 22 criteria they were supplied with. They were also requested to look at the manuscripts with the aim of assisting authors to produce good quality presentations.

Following the review process, the editorial committee considered the reviewers' comments and 13 manuscripts were found to be unsuitable for publication. Reports were forwarded to the remaining 40 authors with suggestions of what needed to be addressed. After receiving the re-worked manuscripts, the editorial committee finally accepted 30 for inclusion in the proceedings. This means that the acceptance rate was just about 57%.

TABLE OF CONTENTS

ARE SUPERVISORS 'FREE-RIDERS'? AN ETHICS PERSPECTIVE

Khanyile Makabongwe
University of South Africa

khanym@unisa.ac.za

Abstract

This conceptual paper focuses on the sporadic conundrum wherein some supervisors seem to be behaving in an unethical way by adding their names on students work without making any scholarly contribution to the publication. This presents a conundrum if this practice continues to exist, as they must not be regarded as co-authors. If the publication is from the dissertation or thesis, the supervisor should specify his or her contribution and that the full dissertation form part of the submission. This is likely to minimize allegations that at times, the supervisor simply reshuffles the work of a student and claims to have contributed to the article, as this reorganization and submission of the manuscript to the journal does not qualify them to be co-authors. At times, some students allege that supervisors include names of other people whom they do not know, be it a friend or colleague of a supervisor. It is high time that academic journals in South Africa begin to ensure that the contribution of each author be identified during the submission and that all contact details of each author are included. By and large, this paper argues about the unethicality of some supervisors who just add their names without contribution to the manuscript. Importantly, there is nothing wrong or unethical with supervisors co-authoring or co-publishing with their students.

Keywords: Ethics, publication, student, supervisor

1.   Introduction

The paper seeks to argue that guiding a student by a supervisor does not necessary qualify a supervisor to become the co-author. In certain instances, a supervisor would apprise or ask if a student would want to have his or her work published. It is normal for any student to agree. At times the supervisor would reshuffle or extract that which she or he deems relevant for a particular publication and claim to have co-authored it. It is understandable that publishing is the currency of academia (Koepsell, 2017) and a range of authorship tactics are utilised by academics to reach performance targets (Tung & McKercher, 2017).

According to Selmer and McNulty (2017), publishing in peer-reviewed journals is regarded as an important 'ticket to ride' in pursuing an academic career, and they argue that without publishing, no academic career is possible. There are also allegations about other scholars who have contributed to the writing of the article, who then arbitrarily approach the journal to publish their work without consent from other co-authors. This shows a sense of desperation to get the article published. Disciplinary norms regarding sole versus multiple authorship can influence decisions about hiring, tenure and promotion (Bowen, 2013). Though, sole-authored work is commonly perceived to signify a number of positive characteristics (Apgar & Congress, 2005), the co-authored work may somehow suggest more minds put together. The abilities to independently conceptualise, operationalise, draft and disseminate scholarship are included in co-authorship. In other words, single authorship is widely viewed as a proxy for the development of a certain degree of professional expertise in one's chosen area of scholarship (Kahn, 2014).

It is reported that cases of unethical academic behaviour are on the rise, despite a growing awareness of and focus on the issue of ethical misconduct in research and publishing (Magwa & Magwa, 2016). Some universities have impressed on academics the need to increase faculty research and publication productivity as a means of enhancing their reputation. For one to be considered for promotion or extension of tenure, some faculties would want to know whether you have assisted emerging or novice researchers to get published. This is where at time these subtler forms of unethical behaviour creep in and may present challenges if it goes unnoticed. The need to publish, combined with institutional pressures for funding, promotion and other benefits, contribute a certain extent to the temptation to be inappropriately named as an author, among others (Koepsell, 2017). The growing pressures in higher education to 'publish-or-perish' continue to drive scholars to make sloppy mistakes or even falsify data (Magwa & Magwa, 2016). Fanelli (2010) states that the culture of 'publish or perish' may conflict with the objectivity and integrity of research. Nowadays, the majority of scientific manuscripts have anywhere from two to thousands of co-authors (Budker & Kimball, 2016).

It is a common cause that when a student completes his or her dissertation or thesis, which may be deemed publishable or may make a scholarly contribution in a form of an article, some supervisors encourage students to publish. It is also a common cause that some supervisors refer students during their studentship to academic material that is relevant to

their studies for consideration or inclusion. However, there are questions that beg to be answered by academics, namely: why not guide a student or ex-student to publish his or her work? What is the supervisor'snterest in it? What is co-authorship or co-publishing? What does ethics says about co-publishing? What role does the author play in qualifying as a co-author? Ghaffari et al. (2008) argue that for students to apply what they learnt in ethics education in practice depends on prevalent cultural norms.

Ethical values that are beyond the satisfaction of basic human needs are relevant to each society (Kunsch et al., 2007). This article is by no means suggesting unethicality in either co-publication or co-authorship between students and their supervisors, nor does the author intend becoming polemic about this issue. Instead, this article contributes to the ongoing conversation about ethics in higher education. There are many cognate questions that may be raised during this conversation, but the author chose to focus on the issue of 'supervisor-student' co-authorship.

2.   Mores of co-authorship and ethics

When most people think about ethics or morals, they think about rules separating right from wrong (Magwa & Magwa, 2015). The term 'morale' has Latin origins, while the term 'ethics' has Greek origins, but both terms are synonymous (Schweitzer, 1996) and are often used interchangeably. The most common way of defining ethics is to refer to it as norms of conduct that distinguish between acceptable and unacceptable behaviour (Magwa & Magwa, 2016). The behaviour of supervisors who are riding on the students' work for free is not only unacceptable but unethical too. This somehow represents moral degeneration in pursuit of capitalism or wrongful recognition. The term 'morale' includes the set of rules that are needed for 'moral' behaviour and the term 'ethics' is the 'science of morale, the search of "good" and "fair" attitudes in human conducts' (Kunsch et al., 2007). Unethical behaviour or misconduct in research and publishing straddles across a variety of immoral activities in the book and journal publishing industry, such as plagiarism, inaccurate referencing, data fabrication, falsification of data or inappropriate authorship, to mention but a few (Magwa & Magwa, 2016).

Who should be a co-author of a paper? Ponomariov and Boardman (2016) argue that co-authorship displays acceptable face and content validity as a measure of research

collaboration. Magwa & Magwa (2016) argue that co-authorship is a social phenomenon worthy of study in-and-of-itself. Budker and Kimball (2016) argue that two key questions need to be asked: 'Did the researcher make a meaningful contribution to the project?' and 'Does the researcher understand the complete work well enough to explain and defend it to colleagues?'

Sometimes co-authorships are essentially awarded as charity. This may contribute to promotion and the delivery on contractual obligations by academics. At times, it is done when people are in tenure jeopardy or will soon be in the job market. Colleagues will sometimes stretch the idea of a significant contribution to the breaking point, in order to enhance the career prospects of someone they care about. For academics to get promoted or employed in academia, publication issues are as important as teaching and learning. There are instances where gift authorship happens, which is not the focus of this paper. However, it is important to clarify that such occurs when the author's name is 'gifted' to a paper, especially envisaged reciprocation for some future benefit, such as being 'gifted' on their papers in return (Dighe & Berquist, 2011; Macfarlane, 2015; Strange, 2008).

At worst, Strange (2008) describes gifting as denoting a premeditated agreement between peers, where it is agreed to add the name as an author, in order to give the appearance of higher productivity, even though that person has played no part in the project. There are other instances where a senior academic's name is added on a paper in an attempt to use his or her reputation to improve the paper's chance of success. Dighe and Berquist (2011) refer to this as 'guest or honorary authorships'. In fact, "honorary," "guest," or "gift" authorship dilutes credits due to the people who have actually contributed in the paper, thereby inflating the credentials of the added authors. This behaviour is misleading and should be condemned at all costs. In the event there are errors, whether caused by mistakes or deceits, these authors exonerate themselves by disavowing responsibility and stating that they were not involved in the part of the paper containing error or that they have nothing to do with the paper.

3.   Discussion

Authorship is one of the most visible forms of academic recognition. Authorship conventions differ from one discipline to the next. In some disciplines the lead or primary author is always last, whilst in other disciplines the leader or main author's name always appears first. This

makes it difficult to apportion credit for work done in different situations or disciplines. Generally, the followed trend is having the primary author's name first, and many journals have guidelines that lay out the conventions for authorship. These are some layout technicalities. It is argued that as a primary author you must assume responsibility of ensuring data accuracy, credit of all deserving authors, final approval by authors of final draft, sending the manuscript to an agreed upon journal by all authors, and handling responses to inquiries after the manuscript is published. This should not be seen as usurping other authors' responsibilities of for example exuding confidence in data accuracy and other things. These are some responsibilities of the main or primary author. In many instances of a student-supervisor publication, the supervisor provides his or her details for enquiries, which is somehow problematic as she or he is not the lead author. In certain instances, he or she is collaborating with other scholars as a contact person of the publication. This does not seem ethical, but in a way a promotion of the supervisor as point of contact for potential corroboration for the work in which he or she is the second author.

Some scholars argue that to be an author you must have been involved with initial research design, data collection and analysis, manuscript drafting, and final approval. Therefore, authorship credit should reflect the individual's contribution to the study. In the event of the paper extracted from the thesis or dissertation, the whole dissertation must also be part of the submission and the co-author should indicate his or her contribution as such. Providing funding or resources, mentorship, or contributing research but not helping with the publication itself should not necessarily qualify you as an author. Some supervisors identify the journal to which the manuscript should be sent and request the student or ex-student to develop the manuscript. This type of ex-supervisor or supervisor assumes to have contributed to the writing of the manuscript. In fact, the supervisor only assumed somehow the mentorship role.

Magwa and Magwa (2016) argue that 'academic publishing deals with a wide variety of ethical issues which can be caused by misbehaving authors, editors who abuse their positions or conflicts between commercial interests and principles of editorial freedom and integrity'. In the process of engaging the prospective supervisor for PhD, a question about the activities the prospective student has been engaged into is normally raised: 'What were you busy with recently?' At times, the prospective supervisor would ask the prospective student to add his

or her name on those papers that the student isare presenting and on the manuscripts to be submitted to academic journals. Some supervisors tend to forget that becoming a co-author of a paper is a serious commitment, wherein an individual's scientific reputation is wedded to the validity of the paper (Budker & Kimball, 2016). However, a conundrum with the practice by certain supervisors is that students find themselves generating the whole content of the article(s), despite the fact that there are other authors (including the supervisor and/or his or her friend(s)/colleague(s) who will be just added without making any contribution to the writing). The relationship between the number of authors per article and dissemination in high-impact disciplinary journals is a commonly used proxy for article quality.

Moustafa   2016:390)
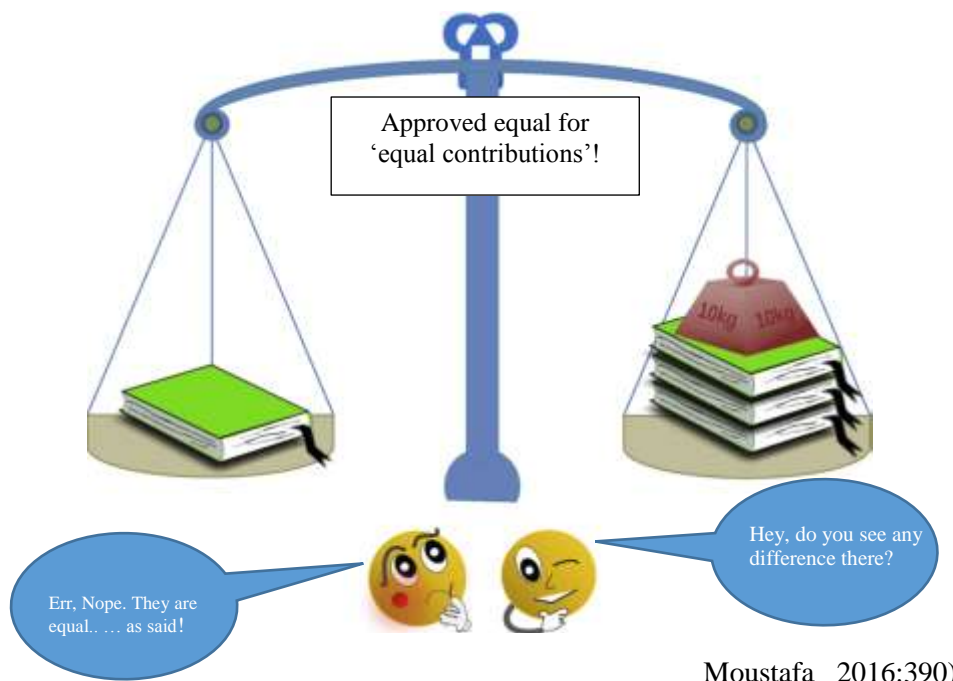
Ponomariov and Boardman (2016) argue that anecdotally, certain individuals may be listed as authors on a particular publication for many reasons other than their research contribution. Budker and Kimball (2016) highlight that is vital to establish and follow ground rules in terms of how the author list will be determined. Magwa and Magwa (2016) posit that editors have to ask authors to submit, as part of their initial submission package, a statement that all individuals listed as authors meet the appropriate authorship criteria, and that nobody who qualifies for authorship is omitted from the list. According to Budker and Kimball (2016),

'author contribution' sections should be included, even for journals that do not require them, spelling out who did what and who is responsible for which parts of the manuscript. Bozeman and Youtie (2016) indicate that there is no consensus on ''deserving'' or on what type of contribution suffices for a co-authorship award. Ponomariov and Boardman (2016) argue that several dimensions of co-authorship are informal and relational, with little to do directly with intellectual and/or other resource contributions. Biagioli (2003) posits that authorship is a reward and that it 'is not per se caused by the intellectual contribution the author makes, meaning that authorship ascription can be a function of things other than intellectual contribution'. The issue of co-authorship without intellectual and scholarly contribution should be questioned from an ethical point of view. The percentage of single-authored papers has decreased (Ductor, 2015) and the mean number of authors per paper has risen within several disciplines (Geminiani *et al.*, 2014). In other parts of the world, collaborative research is encouraged. Authorship plays a significant role in determining the value of published works (Bowen, 2013). The term 'author' needs to be examined in more detail before attempting to provide a definitional meaning of 'co-authorship'. The behaviour of supervisors who are involved is such unethical behaviour should be nipped in the bud, as they stand to gain fraudulently from 'free-riding' on a student's work. In extreme cases, they even want to appear as first authors, which Kwok (2005) describes as 'white bulls' or 'white bullies'.

4.   Conclusion

Tung and McKercher (2017) argue that the academic landscape has changed dramatically. New and controversial tendencies in authorship and contributorship activities are gaining currency and are increasingly evident in scientific publications, and authorship inflation (an increase in the number of authors on a single manuscript) has been reported in many domains (Moustafa, 2016). Contributorship is defined as authors declaring in detail, in advance of publication, their individual contributions to scholarly papers (Rennie, 2001). As the number of authors increases, authorial contribution is also compromised, including work that was authored by a student. The prevailing demeanour of certain academics who fall within the category of 'free-riding' is characterised by moral decay and ethics degeneration. It is not unusual for supervisors to assist and/or guide students in publishing their work, but for supervisors to become 'free-riders' is a question of ethics. In this regard, the interest(s) of supervisors should not be seen to supersede their teaching responsibility. This paper does not

seek to challenge co-publication or co-authorship, as it has its own benefit for students as well, but it is unethical for those supervisors to become 'free-riders', and this practice must be stopped. If the supervisor wants to have his or her name added on an article, he or she needs to contribute towards the writing of the article. It is even worse in instances where the student does not even know the other person added as a co-author by the supervisor. In these instances, those supervisors would argue that they asked the person whose name is added to something, either typing or editing with consulting the lead author, in this case a student. Tung and McKercher (2017) argue that there are many instances where authors' names are just added in expectation of some reciprocal benefit, or because of pressure. The arguments reverberating in different academic corridors about ethical relativism superseding ethical universalism do not hold in this regard. Morality and ethicality are the norms of academic demeanour, irrespective of the circumstances. The author suggests that a code of ethics in relation to co-authorship, in order to curb unwanted behaviour, should be developed for the academic community. This would assist in maintaining professional standards and in promoting ethics and justice in the academic reward system.

If co-authorship exists between the student(s) and supervisor(s), or anyone else for that matter, the full team must read and agree on the final version before publication. Budker and Kimball (2016) emphasise that this is not only a courtesy to authors, but is the cornerstone of scientific ethics. Magwa and Magwa (2016) argue that contributors who do not qualify as authors should be listed, and their contribution should be described in the acknowledgements. Also, universities need to tighten their grip on any unethical behaviours of this nature, and should be responsible for initiating programmes in which students or alumni may be assisted to convert their dissertations or theses into articles. The paper recommends that empirical studies are conducted to establish the causes and effects of 'free-riding' and how to remedy it, as this sometimes poses reputational risks to and compromises the integrity of both the 'free-rider' and the affiliated institution. There is a great need for institutions of higher learning, as well as journals, to also tighten their grip in a bid to eliminate this act of parasitism.

References

Apgar, D. H., & Congress, E. (2005). Authorship credit: A national study of social work educator's beliefs, *Journal of Social Work Education*, *41*(1), 101–112.

Biagioli, M., & Galison, P. (2003). *Scientific authorship: Credit and intellectual property in science.* New York, NY: Routledge.

Bowen, N. K. (2013). Social work authorship. *Social Work Research*, *37*(1), 3–13.

Bozeman, B., & Youtie, J. (2016). Trouble in paradise: Problems in academic research co-authoring. *Science and engineering ethics*, *22*(6), 1717-1743.

Budker, D., & Kimball, D.J. (2016). Paper craft. *Nature*, *529* (7586), 427-428.

Dighe, M. K., & Berquist, T. H. (2011). Education in authorship ethics: Should it be compulsory? *American Journal of Roentgenology*, *196*(2), 235-236.

Ductor, L. (2015). Does co-authorship lead to higher academic productivity? *Oxford Bulletin of Economics and Statistics*, *77*(3), 385–407.

Fanelli, D. (2010). Do pressures to publish increase scientists' bias? An empirical support from US States Data. *PloS ONE*, *5*(4), e10271.

Geminiani, A., Ercoli, C., Feng, C., & Caton, J. G. (2014). Bibliometrics study on authorship trends in periodontal literature from 1995–2010. *Journal of Periodontology*, 85(5), e136–43.

Ghaffari, F., Kyriacou, O., & Brennan, R. (2008). Exploring the Implementation of Ethics in U.K. Accounting Programs. *Issues in Accounting Education*, *23*(2), 183–198.

Kahn, J. M. (2014). Social work scholarship: Authorship over time. *Journal of Social Work Education*, *50*(2), 262–273.

Koepsell, D. (2017). Issues of Authorship. In *Scientific Integrity and Research Ethics* (pp. 25-36). Springer International Publishing.

Kunsch, P.L., Theys, M., & Brans, J.P. (2007). The importance of systems thinking in ethical and sustainable decision-making. *Central European Journal of Operations Research*, *15*(3), 253-269.

Kwok, L. S. (2005). The White Bull effect: Abusive co-authorship and publication parasitism. *Journal of Medical Ethics*, *31*(9), 554- 556.

Langlois, L., & Lapointe, C. (2010). Can ethics be learned? Results from a three-year action-research project. *Journal of Educational Administration*, *48*(2), 147–163.

Magwa, S., & Magwa, W. (2015). *A guide to conducting research: A student handbook.* Houston: Strategic Book Publishing and Rights Co.

Magwa, W., & Magwa, S. (2016). Minimising unethical behaviour in research and publishing: An author's perspective. *Education Research Journal*,. *6* (12), 228 – 234.

Moustafa, K. (2016). Contributorships Are Not 'Weighable'to be Equal. *Trends in biochemical sciences*, *41*(5), 389-390.

Nathan, D. (2015). How South African societal and circumstantial influences affect the ethical standards of prospective South African Chartered Accountants. *African Journal of Business Ethics*, *9*(1), 44-62.

Ponomariov, B., & Boardman, C. (2016). What is co-authorship?. *Scientometrics*, *109*(3), 1939-1963.

Rennie, D. (2001). Who did what? Authorship and contribution in 2001. *Muscle and Nerve*, *24*(10), 1274–1277.

Schweitzer, A. (1996). *Kultur und Ethic: reprint of an original work published in 1923*. Verlag C.H. Beck, Munchen.

Selmer, J., & McNulty, Y. (2017). Publishing research on expatriates: Advice for Ph. D. candidates and early career researchers. *Research Handbook of Expatriates.* Cheltenham: Edward Elgar.

Strange, K. (2008). Authorship: Why not just toss a coin? *American Journal of Physiology-Cell Physiology*, *295*(3), 567-575.

Tung, V.W.S., & McKercher, B. (2017). Negotiating the rapidly changing research, publishing, and career landscape. *Tourism Management*, *60*, pp.322-331.

CHAID MODELLING OF SCHEMA CONSTRUCTION EXPLAINED BY APPROACHES TO LEARNING

Ephraim Zulu[1], Vittorio Tramontin[2] and Theodore Haupt[3]

University of KwaZulu-Natal, South Africa[1,2]

Mangosuthu University of Technology, South Africa[3]

Abstract

This study explores the relationship between approaches to learning and schema construction in undergraduate students. Students either engage in a deep or surface learning (memory learning) approach. Studies have explored how approaches to learning affect academic achievement generally and how they affect achievement in specific subject areas. Using CHAID modelling, the findings of this study show that deep learning is a significant predictor of schema construction. Memory learning was also a significant predictor of schema construction for students who either "sometimes" or "often engaged" in a deep learning approach. This suggests that memory learning may moderate the relationship between approaches to learning and schema construction or academic achievement generally.

Keywords: CHAID, Schema, Learning Approaches, Deep Learning, Memory Learning

Introduction

Learning approaches are student strategies for learning. Learning approaches are generally grouped into two, namely deep approaches learning and surface or memory learning approaches with some authors adding other dimensions such as strategic learning and achieving learning as dimensions of deep learning (von Stumm & Furnham, 2012; Yusoff & Arifin, 2015). Deep learning approaches and their other reported dimensions consist of exploring a topic to the greatest possible extent to achieve a greater understanding of the topic (von Stumm & Furnham, 2012). Several studies have reported the importance of learning approaches to academic achievement (Bakhtiarvand, Ahmadian, Delrooz, & Farahani, 2011; Chen & Hu, 2013; Çolak & Kaya, 2014; Genc & Tinmaz, 2013). Azar, Lavasani, Malahmadi, and Amani (2010) found that deep learning approaches positively influenced mathematics achievement. Several other studies have reported the positive influence of a deep learning approach on academic achievement. Surface learning, on the other hand, consists of learning only what is needed to pass and are often characterized by superficial knowledge of the topic through memorization (von Stumm & Furnham, 2012).

Azar, Lavasani, Malahmadi and Amani (2010) found that a surface learning approach negatively influenced mathematics achievement while Hasnor, Ahmad, and Nordin (2013) found a negative correlation between memory learning and academic achievement.

While many studies have studied the relationship between learning approaches and academic achievement, none have studied the relationship with schema construction. Schema construction is a conceptualisation of learning based on schema theory. A schema is a group of common and logical notions which constitute a network of relationships that make up a person's knowledge and understanding structure (Hummel & Nadolski, 2002). It is anything that is learnt and is treated as a single entity by working memory and can incorporate a large and complex amount of information (Hummel & Nadolski, 2002; Kirschner, 2002; van Bruggen, Kirschner, & Jochems, 2002). Effective learning consists of the development and automation of schemata (Hummel & Nadolski, 2002).

Therefore, this research sought to explore the relationship between approaches to learning and schema construction. Specifically, the research addressed the question "What approaches to learning consistently predict schema construction? Schema construction is viewed as a better measure of learning than academic achievement since it attempts to measure the cognitive development in students due to learning activities. Conceptualising learning this way and relating it to learning approaches could validate other studies on the effects of different learning approaches. The research question was answered using Chi-square Automatic Interaction Detection (CHAID) modelling. CHAID modelling is a predictive decision tree based technique for determining a dependent variable by independent variables (Díaz-Pérez, Bethencourt-Cejas, 2016). The approach has been little used in research on education. It is therefore expected that using this different methodological approach to a fairly well researched topic in educational research could either provide new insights or validate already accepted research findings.

Research Methods

A quantitative research design with a positivist philosophy and a deductive research approach were used because the study sought to test hypothesized relationships among the study variables to which the quantitative design, a positivist philosophy and a deductive approach are all well suited (Saunders, Lewis, and Thornhill 2012; Sekaran and Bougie, 2010). The favoured data collection method was a cross sectional questionnaire survey due to the

objectivity and low cost associated with its use compared to other methods of data collection. Non probability sampling was used for convenience and economy.

Table 1 – Demographic Information

Year of Study	Frequency	Percentage
1	71	26.0%
2	30	11.0%
3	61	22.3%
4	111	40.7%
Total	**273**	**100%**
Gender	**Frequency**	**Percentage**
Male	158	57.9%
Female	115	42.1%
Total	**273**	**100%**
Program of Study	**Frequency**	**Percentage**
Construction Management	128	46.9%
Quantity Surveying	93	34.1%
Property Studies	52	19.1%
Total	**273**	**100%**

The research sample was drawn from three public universities in the province of KwaZulu-Natal in South Africa. The public universities were selected based on the convenience of proximity to the domicile of the researchers. All students present at the time of distributing the questionnaire were included in the sample. The students were not informed beforehand that the questionnaire would be circulated and so class attendance and therefore the sample was not influenced by the questionnaire administration. The questionnaires were circulated to students at the start of lectures. Students were assured of confidentiality and anonymity and also notified of their right not to participate or withdraw from the study at any time and for any reason. This was in tandem with the ethical conduct demanded by the university ethics committee. A sample of 273 responses from the students at the three public universities was obtained with demographics information as shown as shown in Table 1. The table shows the distribution of the respondents by year of study, gender and by programme of study. The population of interest was all student undertaking construction related programmes at the three selected public universities.

Results and Data Analysis

Measurement Instrument Analysis

The measurement instrument for the study is shown in Table 2. The instrument was subjected to factor analysis using IBM SPSS version 25 software to establish whether the items converged on the respective constructs as hypothesised *a priori* using principle component extraction with eigen values greater than 1.0 and Equamax with Kaiser Normalization. Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.827 and the Bartlett's Test of Sphericity was significant (p=0.000) indicating that the sample size was adequate for factor analysis.

Table 2 – Measurement Instrument

High Order Learning	
HiLn1	I studied the basic elements of a point, an idea, experience, or theory, in depth and considered its components
HiLn2	I combined and organised points, ideas, information, or learning experiences into new and more complex understanding, interpretations or relationships
HiLn3	I judged the value of information, arguments, or methods and lessons that I learned.
HiLn4	I applied theories or concepts that I learnt in class to practical problems or in new situations
Integrative Learning	
IntLn1	I worked on assignments or projects that required using ideas or information from various sources and modules
IntLn2	I looked at problems from several different points of view in class discussions or when writing assignments
IntLn3	I used ideas or concepts from other modules when completing assignments or during class discussions
IntLn4	I discussed ideas after studying or after classes with lecturers outside of class
IntLn5	I discussed ideas from my studies or classes with others outside of class (classmates, other students, family members, co-workers, etc.)
Reflective Learning	
RefLn1	I thought about the strengths and weaknesses of my own views and opinions on a topic
RefLn2	I tried to understand other people's views by thinking about how an issue or point looked from their perspective or view point
RefLn3	I learned something new or different that changed the way I understand things or a concept from another module
RefLn4	I learned something new or different from discussing difficult questions that have no clear answers

RefLn5	I used what I learned in a module in other modules
RefLn6	I enjoy doing assignments that require a lot of thinking and mental effort

Memory Learning

MemLn1	I rehearse or practice until I can reproduce a definition word by word
MemLn2	If I do not understand a part of the learning material I just memorise it so that I do not forget it
MemLn3	I try to memorize everything that might be covered in my tests
MemLn4	I memorize as much as possible

Schema Construction and Automation

SchCon1	My lecturers concentrated on making me understand the basic concepts and principles (points) of a module/subject
SchCon2	My lecturers concentrated on making me connect new concepts and principles (points) with what I already knew
SchCon3	I connected points that I already knew with what I was being taught in class
SchCon4	I organised, categorised or connected anything new that I learnt with what I already knew
SchCon5	My lecturers clearly highlighted the main concepts and principles

The study constructs were assessed for reliability and validity. Reliability was assessed using Cronbach's alpha, inter-item correlations, composite reliability (CR) and average variance extracted (AVE). Cronbach's alpha for all constructs ranged between 0.615 and 0.855 which exceeded the recommendation of 0.60 by Hair et al. (2010). Item-to-total correlations ranged between 0.381 and 0.762. Therefore, some of the item-to-total correlations failed to meet the threshold of 0.50 recommendation by Hulland (1999) suggesting a poor reliability of these constructs. A threshold of 0.60 is recommended for CR (ibid). Fornell and Larcker (1981) recommend AVE values to be greater than 0.50. However, three of the constructs had AVE values less than 0.50 indicating a marginally acceptable AVE for the constructs for these constructs. The three constructs which consistently exhibit poor reliability are HiLn, IntLn and RefLn suggesting that the items used to measure the constructs are poor measures. For discriminant validity to exists, the square root of the AVE should be less than the shared variance (inter correlation) between the two constructs (Fornell and Larcker, 1981). Evidence of discriminant validity can be seen in Table 3 which shows the square root of the AVE in bold in the diagonal and the inter-construct correlation in the remainder of the table. All the inter-construct correlations are less than the square root of the AVE indicating good discriminant validity.

Table 3 – Measurement Instrument Analysis

| Research Constructs | | Mean | Cronbach's Test | | C.R. | AVE | Communalities | Item Loadings |
			Item-total	α Value				
High Order	HiLn1		0.499				0.724	0.738
Learning	HiLn2	3.604	0.549	0.685	0.472	0.366	0.596	0.580
	HiLn3		0.419				0.592	0.544
	HiLn4		0.412				0.468	0.535
Integrated	IntLn1		0.429				0.714	0.642
Learning	IntLn2	3.891	0.514	0.647	0.513	0.391	0.635	0.629
	IntLn3		0.430				0.536	0.605
Reflective	RefLn1		0.381				0.658	0.540
Learning	RefLn2	3.734	0.498	0.615	0.414	0.324	0.630	0.626
	RefLn3		0.398				0.654	0.538
Memory	MemLn2		0.520				0.668	0.747
Learning	MemLn3	3.597	0.732	0.798	0.879	0.692	0.815	0.880
	MemLn4		0.689				0.805	0.863
Schema	SchCon1		0.655				0.673	0.760
Construction	SchCon2		0.762				0.751	0.812
	SchCon3	3.759	0.666	0.855	0.693	0.521	0.693	0.712
	SchCon4		0.667				0.639	0.660
	SchCon5		0.594				0.570	0.653

The constructs were tested for normality in order to establish whether to use parametric or non-parametric analyses.

Table 4 – Tests of Normality

| | Kolmogorov-Smirnova | | | Shapiro-Wilk | | |
	Statistic	df	Sig.	Statistic	df	Sig.
HiLn	0.139	268	0.000	0.964	268	0.000
IntLn	0.116	268	0.000	0.955	268	0.000
RefLn	0.100	268	0.000	0.968	268	0.000
MemLn	0.121	268	0.000	0.949	268	0.000
SchCon	0.084	268	0.000	0.971	268	0.000

a. Lilliefors Significance Correction

The Shapiro-Wilk test of normality was used. It tests the null hypothesis that the sample is drawn from a normally distributed population. Results of the test are shown in Table 4. The null hypothesis is rejected since all the p-values for the constructs are significant ($p=0.000$) and so it can be concluded that he data does not follow a normal distribution. Therefore, only non-parametric tests will be conducted.

A cross tabulation correlation of the constructs was done to check for discriminant validity. The non-parametric Spearman's Rho is reported in Table 5. The square root of the AVE is shown in bold in the diagonal of the table. All the inter-construct correlations are less than the square root of the AVE indicating good discriminant validity.

Table 5 – Inter-Construct Correlations and Discriminant Validity

	HiLn	IntLn	RefLn	MemLn	SchCon
HiLn	**0.605**				
IntLn	0.497**	**0.625**			
RefLn	0.495**	0.409**	**0.569**		
MemLn	0.090	0.136*	0.136*	**0.832**	
SchCon	0.390**	0.425**	0.355**	0.100	**0.722**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

CHAID Analysis

Chi-square Automatic Interaction Detection (CHAID) was the preferred data analysis methodology. CHAID is a distribution free (non-parametric) data analysis methodology which predicts a target variable using a decision tree. The analysis was chosen firstly because it was suggested by the *Auto Numeric* function of the IBM SPSS Modeller version 18.1 software. The *Auto Numeric* function suggests the appropriate data analyses based on the data set. Secondly, since the data were found to be non-parametric, the CHAID analysis was appropriate (Díaz-Pérez, Bethencourt-Cejas, 2016). Figure 1 shows the IBM SPSS Modeller version 18.1 graphic user interface (GUI) of the data analysis. Results of the CHAID are shown in Figure 2.

Figure 1 – IBM SPSS Modeller Data Analysis GUI

The CHAID model in Figure 2 shows that the most significant (p=0.000) predictor of SchCon is HiLn. In predicting SchCon, HiLn breaks up into three groups of respondents. The first group comprised of about 21% of respondents who responded either "almost never" or "seldom" in in response to phrases in HiLn. The second group comprised of about 61% of respondents who responded either "sometimes" or "often" to phrases in HiLn while the third group comprised of 18% of respondents who responded "almost always". For the respondents who responded either "sometimes" or "often", MemLn was a significant predictor of HiLn. Of the 18% who responded almost always, IntLn was a significant predictor of HiLn with the majority of then responding either "often" or "almost always" to phrases in HiLn. Therefore, respondents who responded "almost always" to HiLn are very likely to have also responded either "often" or "almost always" to IntLn.
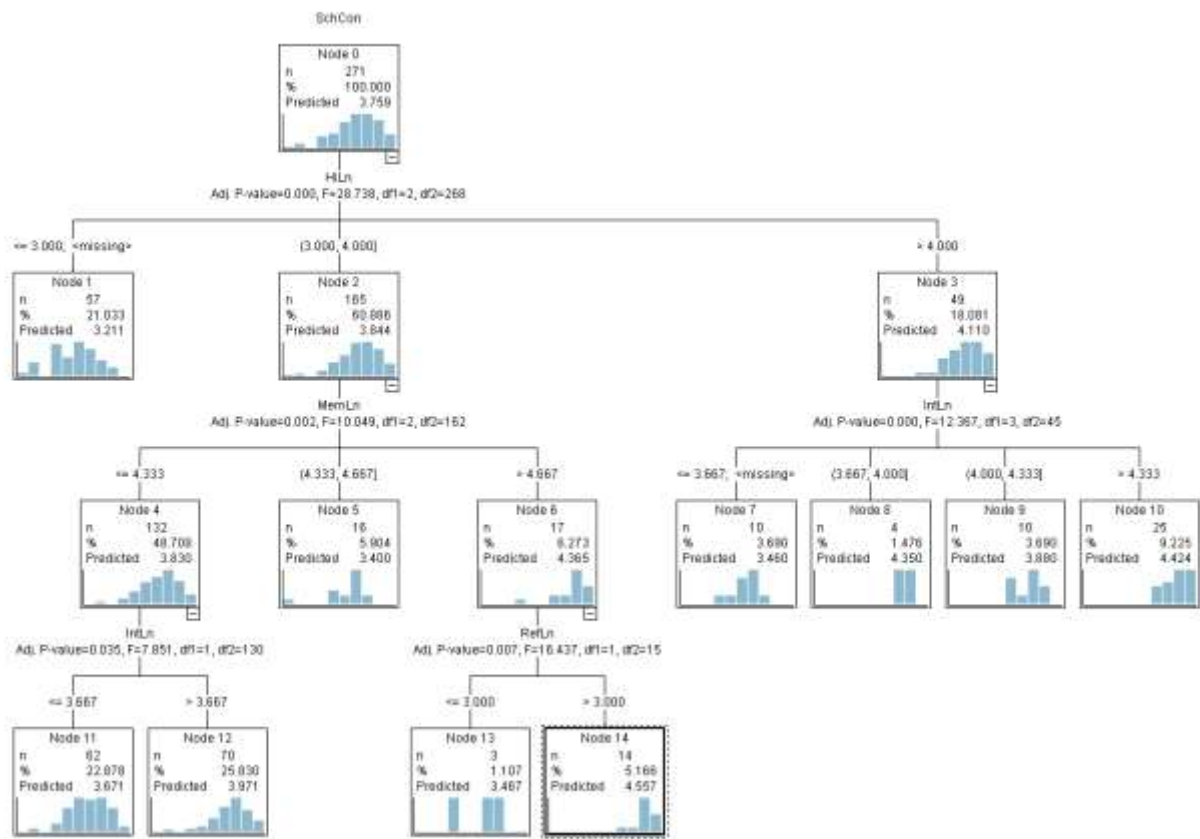
Figure 2 – CHAID Model of Schema Construction and Learning Approaches

Discussion of Findings

This study sought to investigate the relationship between student approach to learning and their engagement in schema construction. Specifically, the study sought to establish the approach to learning which predicted schema construction using CHAID modelling. Many studies have investigated the relationship between approach to learning and academic achievement. However, no studies were found which related approach to learning to schema construction nor any which used CHAID modelling. This study preferred to relate approach to learning to schema construction because approach to learning has been shown to have a significant impact on learning. Schema construction, rather than academic achievement, was used to conceptualise learning because it was felt that the creation of knowledge structures, which is schema construction, rather than academic achievement, more closely models learning. Similar studies but using different analyses and a different conception of learning have found that a deep learning approach positively influences learning (Bakhtiarvand et al., 2011; Chen & Hu, 2013; Çolak & Kaya, 2014; Genc & Tinmaz, 2013).

Consistent with other studies, it was found that a deep learning approach positively impacts on schema construction. However, and surprisingly, it was also found that a memory learning approach also consistently predicted schema construction among students who "sometimes" and "often" engaged in deep learning. However, students who indicated that they "almost always" engaged in deep learning never engaged in memory learning. Research on student approaches to learning has consistently shown that a deep learning approach is associated with academic achievement (Bakhtiarvand et al., 2011; Chen & Hu, 2013; Çolak & Kaya, 2014; Genc & Tinmaz, 2013). Consistent with previous studies, deep learning was found to significantly predict schema construction. However, results also show that students who engaged in deep learning also engaged in memory learning as well. The decision tree results show that students who "sometimes" or "often" engaged" in a deep learning approach also engaged in memory learning. Therefore, memory learning may moderate the relationship between deep learning approach and academic achievement in students who engage in both deep learning and memory learning. Students who indicated that they "almost always" engaged in deep learning did not have memory learning play any role in predicting their level of schema construction. This is consistent with findings that deep learning is associated with academic achievement.

Conclusion

While it accepted that deep learning is a stronger predictor of academic achievement and so learning, the findings from this study suggest that for students who engage in both deep learning and memory learning, memory learning is also associated with effective learning. Therefore, memory learning may be a moderator of the relationship between approach to learning and academic achievement or learning in students who engage in both deep learning and surface learning approaches. This particular finding is important because the findings show that about 61% of the students engaged in both deep learning and memory learning. Therefore, the effect of engaging in both deep learning and memory learning has implications for the majority of students.

The findings from this study have limitations. Firstly, the psychometric properties of some of the scales used were not completely satisfactory. Therefore, better scales need to be used in order to verify the findings. Secondly, the claim that memory learning may be a moderating variable needs to be verified with further studies memory learning as a moderating variable would need to be conducted to verify this suggestion.

Acknowledgements

References

Azar, H. K., Lavasani, M. G., Malahmadi, E., & Amani, J. (2010). The role of self- efficacy, task value, and achievement goals in predicting learning approaches and mathematics achievement. *Procedia - Social and Behavioral Sciences, 5*, 942-947. doi: http://dx.doi.org/10.1016/j.sbspro.2010.07.214

Bakhtiarvand, F., Ahmadian, S., Delrooz, K., & Farahani, H. A. (2011). The Moderating Effect of Achievement Motivation on Relationship of Learning Approaches and Academic Achievement. *Procedia - Social and Behavioral Sciences, 28*, 486-488. doi: http://dx.doi.org/10.1016/j.sbspro.2011.11.093

Chen, T. C., & Hu, M. H. (2013). Influence of Course Design on Learning Approaches and Academic Performance in Physical Therapy Students. *Procedia - Social and Behavioral Sciences, 93*, 97-101. doi: http://dx.doi.org/10.1016/j.sbspro.2013.09.158

Çolak, E., & Kaya, D. (2014). Learning Approaches of Vocational High School Students: Grade Level and School Type Influences. *Procedia - Social and Behavioral Sciences, 116*, 1556-1561. doi: http://dx.doi.org/10.1016/j.sbspro.2014.01.434

Flora M Díaz-Pérez, M Bethencourt-Cejas (2016). CHAID algorithm as an ppropriate analytical method for tourism market segmentation. *Journal of Destination Marketing & Management 5,* 275–282

Fornell, C. & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error, *Journal of Marketing Research* 18 (1), 39-50

Genc, Z., & Tinmaz, H. (2013). Understanding the Learners' Study Process: A Vital Step Toward Better Learning. *Procedia - Social and Behavioral Sciences, 83*, 1049-1053. doi: http://dx.doi.org/10.1016/j.sbspro.2013.06.195

Hair, J. F., Black, W. C., Babin, B. Y. A., Anderson, R. E. and Tatham, R. L. (2010), Multivariate Data Analysis, Pearson Prentice Hall, Essex.

Hasnor, H. N., Ahmad, Z., & Nordin, N. (2013). The Relationship between Learning Approaches and Academic Achievement Among Intec Students, Uitm Shah Alam. *Procedia - Social and Behavioral Sciences, 90*, 178-186. doi: http://dx.doi.org/10.1016/j.sbspro.2013.07.080

Hulland, J. (1999). Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies, *Strategic Management Journal,* 20(2), 195–204

Hummel, H. G. K., & Nadolski, R. J. (2002). Cueing for Schema Construction: Designing Problem-Solving Multimedia Practicals. *Contemporary Educational Psychology, 27*(2), 229-249. doi: http://dx.doi.org/10.1006/ceps.2001.1089

Kirschner, P. A. (2002). Cognitive load theory: implications of cognitive load theory on the design of learning. *Learning and Instruction, 12*(1), 1-10. doi: http://dx.doi.org/10.1016/S0959-4752(01)00014-7

Saunders, M., Lewis, P., & Thornhill, A. (2012). Research Methods for Business Students (6th ed.). Edinburgh Gate, England: Pearson Education Limited.

Sekaran, U., & Bougie, R. (2010). Research Methods of Business: A Skill Building Approach (5th ed.). West Sussex: John Wiley and Sons.van Bruggen, J. M., Kirschner, P. A., & Jochems, W. (2002). External representation of argumentation in CSCL and the management of cognitive load. Learning and Instruction, 12(1), 121-138. doi: http://dx.doi.org/10.1016/S0959-4752(01)00019-6

von Stumm, S., & Furnham, A. F. (2012). Learning approaches: Associations with Typical Intellectual Engagement, intelligence and the Big Five. *Personality and Individual Differences, 53*(5), 720-723. doi: http://dx.doi.org/10.1016/j.paid.2012.05.014

Yusoff, M. S. B., & Arifin, W. N. (2015). Educational environment and psychological distress of medical students: The role of a deep learning approach. *Journal of Taibah University Medical Sciences, 10*(4), 411-418. doi: http://dx.doi.org/10.1016/j.jtumed.2015.08.005

COMMUNITY VIEWS ON INSTITUTIONALISATION OF THE AGED IN OLD PEOPLE'S HOMES IN LUSAKA, ZAMBIA

Moses Changala & Akakandelwa Akakandelwa
University of Zambia
moses.changala@unza.zm; akakandelwa.akakandelwa@unza.zm

Abstract
The study sought to explore community views on institutionalisation of the aged in old people's homes in Lusaka, Zambia. It employed a descriptive survey research design. The sample comprised 30 purposively selected members of the public living within vicinity of Divine Providence Home, the only old people's home in the district. Data was collected using interview and focus group discussion guides. Data was analysed thematically and results presented using key concepts and narrations. The study established that most respondents supported institutionalisation of the aged in old people's homes. Among the reasons they gave were that: an increasing number of people were becoming destitute in old age due to high levels of poverty; a lot of old people lacked relatives to take care of them; old people's homes provided access to a number of services and trained caregivers; and the homes made it easier for the government, non-governmental organisations and other well-wishers to help the needy elderly. It also established that circumstances under which they respondents indicated that they would support institutionalisation of their aged family members in old people's homes were: if they were chronically ill, disabled, insane, too troublesome or too old. The study further indicated that most respondents supported the idea of establishing more old people's homes in the country. Among the reasons they gave were that many old people were lacking care and support, hence they required government intervention; it would help those who were vulnerable to access support and care; it would decongest existing homes; and the existing homes were too few to meet the ever rising demand for the facilities. The study recommended that the government and faith-based organisations should increase funding to old people's homes to enable them provide adequate and appropriate services and care to the aged in residence. It also recommended that government and other stake holders should conduct awareness campaigns and run educational programmes on the need for citizens to treat the aged, both in non-institutional and institutional care, more humanely and accord them the respect and dignity they deserve. The study also recommended that a larger study should be undertaken to establish people's views on institutionalisation of the aged in old people's homes at national level.

Keywords: Community views, institutionalisation, the aged, old people's homes

Introduction
Population ageing is increasingly becoming an issue for concern throughout the world, and particularly, in less developed countries where the growth of the older population is ever more rapid. Population ageing is now seen as a major development challenge, especially in settings where social safety nets do not exist; where there is limited institutional and human

resource capacity and where there are only scarce resources to respond to the health and basic needs of older persons (UNFPA, 2002).

Population ageing is poised to become one of the most significant social transformations of the twenty-first century, with implications for nearly all sectors of society. These include labour and financial markets, demand for goods and services, such as housing, transportation and social protection, as well as family structures and inter-generational ties (World Population Ageing, 2017). As people live longer, the population of older people is growing significantly. This brings with it many social, political and economic challenges (Lyons *et al*., 2009). Many countries encounter a demographic change where the number of elderly people will increase. As a result, the number of old people needing care, services and medical assistance will increase (Harrefors, Sävenstedt & Axelsson, 2009).

Globally the number of the ageing population 60 years and above has increased drastically, with no exception to the Zambian population (Ndonyo, 2011). This study adopted the United Nations' definition of an aged person which stipulates that persons aged 60 years or over are considered aged (HelpAge International, 2012). This is also in line with the Zambian National Ageing Policy (2015) which defines an aged person as a male or female who is 60 years and older. Furthermore, the terms aged, older persons, the elderly and elderly persons were taken to mean the same thing and, therefore, used interchangeably.

Mapoma and Masaiti (2012) posit that views and attitudes towards ageing and the aged by the community are good determinants of older persons' well being. This is also true for the kind of support and care older persons, including those who are institutionalised in old people's homes, may receive**.** How the aged are treated by members of society is, to a certain extent, a reflection of the views they hold about them as well as the attitude they have towards them. Khan (nd.) adds that when older adults are respected by younger individuals, they feel a sense of belonging and acceptance. With positive attitudes, a positive relationship is created between younger individuals and older adults.

In Zambia old people's homes are a form of institutional care for the aged. The Zambian National Ageing Policy (2015) defines old people's homes as homes which keep older persons in need of care and are supported wholly or partly by voluntary organisations. Mangallathil (2011) posits that the advantages of old people's homes are that they provide a safe haven for older persons who have nowhere to go or no one to support them and that the homes create a family-like atmosphere where older persons share their joys and sorrows with each other. Mangallathil (2011) explains that these homes have special medical facilities for senior citizens such as mobile health care systems, ambulances, nurses and provision of well balanced meals to enable them live a healthy life.

Divine Providence Home for the aged is located in a compound called Chawama in Lusaka. The home started as an effort by the local Christian community to accommodate a stranded old woman. A house was, therefore, built for her. However, when more people started

coming to seek similar help, a local priest by the name of Father Angelo Pazica, and the local Christian community applied for a plot from the Council on which the present-day home was built. Funds for construction of the home came from the European Community. In 1992 the home was officially opened by the then area Member of Parliament. In 1994 the house was handed over to the Catholic Holy Family Sisters who are still running it (Kamwengo, 2001).

Statement of the problem

Studies have been conducted on various aspects of ageing in Zambia (e.g. Kamwengo, 1997, Namakando, 2005; Mapoma and Masaiti, 2012; Mapoma, 2013; Changala, 2015). However, there was no known study which specifically sought to explore community views on institutionalisation of the aged in old people's homes to ascertain whether people supported this phenomenon or not. This study, therefore, sought to fill this gap.

Purpose of the study

To explore community views on institutionalisation of the aged in old people's homes in Lusaka.

Objectives of the study

The objectives of the study were to:

1. Establish whether members of the community supported institutionalisation of the aged in old people's homes.
2. Determine circumstances under which members of the community would support institutionalisation of the aged in old people's homes.
3. Establish whether members of the community supported the establishment of more old people's homes.

Literature Review

The literature review is presented under the following themes: institutionalisation of the aged in old people's homes and community attitude and views on old people's homes.

Institutionalisation of the aged in old people's homes

The elderly are a diverse group and experience varying degrees of dependency on external support. The situation of many older persons living in less developed countries is one of extreme poverty and exclusion. They often lack access to adequate and affordable health care and other basic requirements, especially in rural areas. Some are also confronted with psychological and physical abuse. Traditional family support mechanisms are being eroded due to declining family size, rural to urban migration, urbanization and declining co-residence and, in some countries, younger family members dying of HIV/AIDS (UNFPA, 2002). As a result, some older people are left with no support and care hence making them seek shelter in old people's homes.

Mafauzi (2000) points out that institutionalisation of the elderly is quite common and acceptable in the West, but not favoured in Malaysia. Mafauzi (2000), however, states that

with social changes such as migration, urbanisation, increased participation of females in the labour force, changes in family structures, the rapid increase in the number of the aged expected in the future and the longer expectation of life, the number of elderly that would require institutionalisation in Malaysia can be expected to rise. Mafauzi (2000) goes on to explain that the existing institutions for the aged in Malaysia may not be adequate to meet the demand in the near future and so more institutions for the aged may be required.

Kydd and Wild (2013) assert that care for older people is often referred to as a 'cinderella' service and is not seen as an attractive career option in health but with the global population continuing to age, caring for this population may become increasingly important. Kamwengo (2001) points out that although institutional care of the aged in old people's homes was discouraged in Zambia, the government decided to retain these homes as it realised that there would always be some people in institutions of care because of factors such as childlessness and cultural taboos associated with ageing. Kamwengo (2001) explains that the government also realised that there would be some people who may not able to trace their families or remember their villages mainly because of urbanization or illness and that there would always be some people without families to look after them.

Furthermore, a study by Changala (2015) titled: "Caring for the aged in Zambia: implications for adult education programmes" concluded that the phenomenon of old people's homes in Zambia was likely to continue owing to the enduring nature of factors that led to the aged moving to old people's homes in Zambia, such as lack of family members, abandonment related to illness and old age, destitution, harassment of the aged on suspicion that they were practicing witchcraft, and disability. The study also concluded that since old people's homes, as a form of social welfare and social protection mechanism for the aged in Zambia, had been in existence since 1948, they were likely to remain an important mode of care for the aged.

Community attitude and views on old people's homes
People in society may have a positive or negative attitude towards old people's homes and may hold varying views on these institutions. A study by Lam *et al.* (1996) sought to establish community attitudes to institutional care of the aged in Hong Kong. The study asserted that the tradition of living in extended family units in Hong Kong had disappeared over the previous two decades on account of Westernisation and other social changes which had taken place. Lam *et al.* (1996) interviewed a total of 1023 randomly selected adult residents aged 18 years and older by telephone. The two attitudes analysed in the study included attitudes to institutionalisation of the non-disabled elderly and attitudes to the institutionalisation of the disabled elderly. The results of the study showed that nearly 23 % and 57.5 % of the respondents either agreed or strongly agreed with the placement of non-disabled and disabled elderly, respectively. Factors such as the absence of additional help, the migration of close relatives and request for institutionalisation by the elderly themselves were all considered factors that increased the need for placement of the elderly in an institution by the respondents, whether they were disabled or not. However, a poor relationship with the elderly person had the least effect on these attitudes. Physical and behavioural problems by

the elderly also increased the willingness of respondents to consider placing the disabled elderly in an institution, according to the study.

Perista (2010) indicates that the social infrastructure system for the elderly in Portugal is still strongly oriented towards institutional care and less comprehensive forms of community care. Perista (2010) explains that while some shift in philosophy may be detectable, it is also true that instead of moving from institutional care to community care, it seems that residential care is increasingly being complemented with home care. Perista (2010) states that generally, the importance of the family combined with homecare support in Portugal is still largely evident but also points out that people without children seem more reliant on institutional care and keener on using all their available resources to pay for it.

In a study titled: "Abuse of the aged in Nigeria: elders also cry", Mudiare (2013) states that the idea of keeping old people in institutional care still sounds strange for many Nigerians but that it is increasingly difficult for families to cater for them in the absence of any welfare benefits. Mudiare (2013) points out that even those who are on monthly pension will at some point in time require assistance either from a caregiver or a professional health caregiver. Mudiare (2013) concludes that this could include the option of institutional care, much as the Nigerian community may perceive the arrangement negatively.

Mapoma and Masaiti (2012) point out that the Ministry of Community Development and Social Services which is mandated to look after interests of disadvantaged people in society, including the aged and those with certain physical and mental challenges, requires adequate funding and support. Mapoma and Masaiti (2012) state that in strengthening this Ministry, government needs to establish more old people's homes so that as the number of old people is growing and since cases of family abandonment of the aged is also on the increase, such homes would be very critical in reducing or curbing destitution amongst the aged in society.

Methodology
The study employed a descriptive survey research design which was predominantly qualitative. "Descriptive survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals" (Kombo and Tromp, 2006:71). The sample consisted of 30 purposively selected members of the public living within vicinity of Divine Providence Home. Data was collected using interview and focus group discussion guides. Data was analysed thematically by content analysis and results presented using key concepts and narrations. All interviews and focus group discussions were tape-recorded and transcribed for accuracy. Furthermore, verbatims by respondents which were deemed appropriate and critical to the purpose of the study were also considered.

In order to enhance the quality of collected data, the following measures were taken: a tape-recorder was used during interviews and focus group discussions to ensure accuracy of information that was collected; the process of triangulation was employed. Chilisa and Preece (2005) assert that triangulation is one of the strategies for enhancing the credibility of the

study. It is based on the assumption that the use of multiple methods, data sources or investigators can eliminate biases in the study. In this study triangulation of methods, which involved the use of interviews and focus group discussions was employed to enhance the quality of data.

Findings and Discussion
This section presents findings and discussion in line with the objectives of the study.
Whether members of the community supported institutionalisation of the aged in old people's homes
The respondents were asked whether they supported institutionalisation of the aged in old people's homes or not. Most (19) of them indicated that they supported the practice, while 11 said they did not. Among the reasons given by those who supported institutionalisation were that an increasing number of people were becoming destitute in old age due to high levels of poverty; a lot of old people lacked relatives to take care of them; old people's homes provided access to a number of services including trained caregivers; and the homes made it easy for the government, non-governmental organisations and other well-wishers to help the needy elderly. Other reasons given were that it was better to put the aged in old people's homes than to let them beg in the streets; institutionalisation reduced loneliness and isolation among the aged; many old people were often neglected and abused in their communities; many old people were difficult to look after and many old people had health problems.

One respondent said:
It is better to keep the aged in old people's home where they will be with fellow elderly persons as opposed to letting them beg in the streets facing danger or being with relatives who will neglect, abuse and humiliate them.

Another respondent asserted:
Old people are also human beings and have the right to institutional home care. Many families cannot afford to look after old people due to harsh and terrible economic conditions in the country. Besides, some old people have lost all their children to the HIV/AIDS pandemic and have no one to take care of them.

The study established that old people's homes were generally viewed favourably by the respondents. However, the fact that most of the respondents supported institutionalisation of the aged in old people's homes was somewhat puzzling to the researchers. This is because the general notion in Africa and Zambia has been that the aged should be cared for in the extended family set-up as cultural and traditional norms and practices 'dictate' For example, Mudiare (2013) explains that the idea of keeping old people in institutional care still sounds strange for many Nigerians.

Respondents who did not support institutionalisation of the aged in old people's homes gave their own reasons. Among them were that the practice was against African culture and was a white man's concept; families would be encouraged to neglect elderly members; the elderly

were better looked after by their own relatives who better understood their needs; old people's homes lacked personal love and affection; the aged were abused by caregivers in old people's homes; and that since old people had cared for their offspring and made a contribution to society, they in turn, deserved to be cared for within families and that old people's homes were a scar on society from an African perspective.

One respondent participating in a focus group discussion stated:
Family members should be responsible. Old people's homes are a white man's concept. In fact old people do not deserve such places.

Another one added:
Elderly people are our own parents. So we need to take care of them. Therefore, they need to be loved and cared for in our homes and not in institutions. It is against our culture. Remember, old people are a blessing to our country.

The fact that 11 respondents were against institutionalisation of the aged in old people's homes against the 19 who were in favour, indicates that there is still belief in the extended family system as a model of caring for the aged in Zambia. This is consistent with Mudiare (2013) who explains that the idea of keeping old people in institutional care still sounds strange for many Nigerians, it is becoming increasingly difficult for families to cater for their aged parents or relations owing to high poverty levels and other factors.

Circumstances under which the community would support the idea of caring for the aged in old people's homes
Since there were mixed views *vis-à-vis* the idea of caring for the aged in old people's homes, respondents who were opposed to the idea were asked to state circumstances under which they would support institutionalisation of their parents or family members. They stated that they would only do so if the aged were chronically ill, disabled or insane, if they were too troublesome or too old. Others stated that they would do so in there was no one to care for the aged owing to all their children having died or migrated to other countries.

One respondent stated:
Personally, I would support the idea of taking the aged to old people's homes under extreme cases like abject poverty and homelessness and if they have no children of their own or relatives to take care of them.

Another respondent said:
I would, under no circumstance, take my own parents to an old people's home because they are my direct responsible. However, I would support the idea of taking other older members of my family if they are too old, sickly or troublesome.

The finding highlights the fact that although most respondents were not in favour of old people's homes they, however, also acknowledged that there were some exceptional circumstances which would necessitate institutionalisation of the aged in old people's homes. This was also pointed out by Kamwengo (2001) who asserted that although institutional care of the aged in old people's homes was discouraged in Zambia, the government decided to retain the existing ones out of compelling necessity.

Whether members of the community supported establishment of more old people's homes
Most (21) respondents supported the idea of establishing more old people's homes in the country. Among the reasons they gave were that many old people were lacking support and care; there was need to help those who were vulnerable and to decongest existing old people's homes. Other reasons were that HIV/AIDS had wiped the younger ones who should look after old people; existing old people's homes were too few in relation to demand; many families could not afford to look after old people; government had a responsibility to look after old people; the extended family system was quickly dying out and elderly persons deserved protection.

One respondent in a focus group discussion said:
Elderly people deserve protection. Since more and more people are becoming destitute in old age, especially after squandering their meagre terminal employment benefits, there is need for more of such homes to care for them and protect them from possible harm and neglect.

He was supported by another who stated:
Building more old people's homes would make it easy for vulnerable people to be taken care of by the government and its partners in future. This is because the population of older people is growing, meaning that many more may require these facilities.

The implication of the above finding is that most respondents recognised compelling socio-economic, medical, demographic and other factors that would necessitate establishment of more old people's homes in the country. This also implies that as population ageing accelerates, the demand for institutional care for the aged may also grow, especially as the extended family system continues to weaken.

Respondents who did support the establishment of more old people's home gave the following reasons: it is the duty of the family to look after elderly persons; establishing more homes will encourage families to abandon looking after the aged; old people's homes encourage disintegration of family ties; the government does not fund these homes adequately; some non-governmental organisations, community-based organisations and faith-based organisation just take advantage of old people's homes to beg for money from donors; it is a waste of government resources; it is culturally not allowed; it is a sign of disintegrated family morals; old people's homes are like dumping places for old people; and Zambia does do not have so many elderly people who have no relatives to look after them.

One respondent stated:

Instead of building more homes, it is better to educate and sensitise families to look after old people. Family values should be promoted in the country.

Another respondent added:

It is better to just expand and maintain the existing old people's homes. Already, the government does not adequately fund the existing homes. So why put up some more? It will be a sheer waste of resources.

The above finding implies that some respondents were against the idea of putting up more old people's homes in Zambia for fear that it may promote neglect and abandonment of older persons. Although they did not advocate abolition of old people's homes, they were against their expansion of proliferation. They believe that older people should, as much as possible, be helped and encouraged to live among their family members and taken care of within their community.

Conclusion

The study concluded that although institutionalisation of the aged in old people's homes was a seemingly controversial practice in Zambia, majority of the respondents in Lusaka district supported it in the belief that some older persons may not have families or relatives to look after them. The study also concluded that the phenomenon of old people's homes would continue as the population of the aged increases and extended family ties continue to weaken.

Recommendations

The study made the following recommendations:

1. The government and faith-based organisations should increase funding to old people's homes to enable them provide adequate and appropriate services and care to the aged in residence.

2. The government and other stake holders should conduct awareness campaigns and run educational programmes on the need for citizens to treat the aged, both in non-institutional and institutional care, more humanely and accord them the respect and dignity they deserve

3. A large-scale study should be undertaken to explore views people have on institutionalisation of the aged in old people's homes at national level in order to establish the extent to which they would support the practice or not.

References

Changala, M. (2015). Caring for the aged in old people's homes in Zambia: Implications for adult education programmes. PhD Thesis, University of Zambia, School of Education.

Chilisa, B. & Preece, J. (2005). Research methods for adult educators in Africa. Cape Town: Pearson Education.

Harrefors, C., Sävenstedt, S. & Axelsson, K. (2009). Elderly people's perception of how they want to be cared for: An interview study with healthy elderly couples in Northern Sweden. *Scand J Caring Sci*, 2, 353-360.

HelpAge International (2012). Ageing in the twenty-first century: A celebration and a challenge, London: HelpAge International.

Khan, N.A. (Nd.). Student attitudes about older adults: Caring and cultural assimilation. *McNair Scholars Journal,* 12(1), 152-177.

Kamwengo, M.M. (2001). Ageing and the elderly in Zambia: Perspectives and issues. New Delhi: Sterling International.

Kombo, D.K. & Tromp, D.L.A. (2006). Proposal and thesis writing. Nairobi: Paulines Publications Africa.

Kydd, A. & Wild, D.J. (2013). Attitudes towards caring for older people: Literature review and methodology, *Nursing older people*, 25(3), 22-28.

Lam, T.P. *et al* (1996). Community attitudes to institutional care of the aged in Hong Kong, *Medical Journal*, 2(1), 10-17.

Lyons, I. *et al.* (2009). Public perception of older people and ageing: A Literature Review. Dublin: National Centre for Protection of Older People.

Mafauzi, M. (2000). The problems and challenges of the ageing population of Malaysia, *Malaysia Journal of Medical Sciences*, 7(1), 1-3.

Mangallathil, M. (2011). Advantages of age-homes http://www.thebestdayofmylife.in/2011/06/advantages-of-age-homes.html (Accessed on 20/08/18).

Mapoma, C.C. (2013). Population ageing in Zambia: Magnitude, challenges and determinants. PhD Thesis, University of Zambia, Department of Population Studies.

Mapoma, C.C. & Masaiti, G. (2012). Perceptions of and attitudes towards ageing in Zambia, *European Journal of Educational Research*, 1(2), 107-116.

Ministry of Community Development and Social Services (2015). National ageing policy, Lusaka, MCDSS.

Mudiare, P.E.U. (2013) Abuse of the aged in Nigeria: Elders also cry. *American International Journal of Contemporary Research*, 3(9), 79-87.

Namakando, P. (2004). A phenomenological study of ageing amongst the older persons in Zambia. PhD Thesis. University of South Africa, Department of Health Studies.

Ndonyo, R.L. (2011). Situational analysis of healthy ageing programme in Zambia: A report for the World Health Organisation. Lusaka: University of Zambia, School of Medicine, Department of Community Medicine.

Oldman, C. & Quilgars, D. (1999). The last resort? Revisiting ideas about older people's living arrangements. *Ageing and Society*, 19, 363-384.

Perista, P. (2010). Strategies and expectations regarding retirement and care and the role of housing equity: the case of Portugal. Teorija in Praksa, 47(5), 1044-1061.

Schuller, T & Bostyn, A.M. Education and training for the third age: A preliminary report from the Carnegie Inquiry, *International Journal of Education*, 38(4), 375-392.

UNFPA (2002). Situation and voices: The older poor and excluded in South Africa and India. New York: UNFPA.

United Nations (2017). World Population Ageing. Department of Economic and Social Affairs, Population Division, New York: United Nations.

PERCEPTIONS OF TEACHERS ON A NATURAL SCIENCES IN-SERVICE TRAINING IN THE GAUTENG PROVINCE

Nkopodi Nkopodi & Awelani V. Mudau
Department of Science and Technology Education

University of South Africa

mudauav@unisa.ac.za

Abstract

This is an interpretative qualitative study, which investigated a project by the South African Agency for Science and Technology Advancement (SAASTA). SAASTA's approach was to conduct workshops for teachers from previously disadvantaged communities in the provinces of Limpopo and Gauteng. So all the teachers that attended the workshop where the sample from which data was collected. The project was evaluated by interviewing teachers using focus groups to determine their perceptions on how the workshops contributed to their professional development. The findings indicate that the majority of the teachers valued knowledge and skills learned from the workshops. These findings further show how an organisation can contribute to knowledge and skills acquisition for curriculum implementation and can serve as an example for others with similar objectives particularly in developing countries. Recommendations were that there is a need of more in-service training of this nature in other provinces

Keywords: INSET, in-service, teacher training, workshops, science activities.

INTRODUCTION

Post-school institutions are actively involved in INSET (Desimone, Garet, Birnam, Porter and Yoon 2003). Desimone et al. (2003) found that in the USA, non-formal INSET (in-service training) programmes account for 76 per cent of teacher development programmes. While there is dearth of information about the equivalent percentage in South Africa, this widespread usage of non-formal INSET programmes makes it necessary for us to know about their successes. The success of INSET programmes is affected by features such as the duration of the programme, participation of groups from the same school or grade, opportunities for active learning, content knowledge focus, coherence in teachers'

professional development as well as management and implementation strategies (Desimone et al. 2003).

In the South African context, Chuene (1997) found that, in contrast to pre-service teachers, practising teachers expect emphasis on content knowledge from an INSET programmes. In another study, student teachers were found to have difficulties with problems relating to the real world (Verschaffel, De Corte and Borchart 1997). These findings suggest that pre-service programmes do not place enough emphasis on content knowledge or its application and some teachers realise this only when they are in a teaching and learning environment.

Difficulties mentioned in the aforesaid South African and international studies point to challenges in teacher pedagogical content knowledge (Jita and Ndlalane 2009; Taylor and Vinjevold 1999; Desimone et al. 2003). These findings suggest that there is a need to help teachers with content knowledge and innovative activities that enhance interest in torching science subjects. In conducting the primary science day project, SAASTA envisaged that it was critical to improving teachers' content knowledge and pedagogical knowledge using familiar contexts and simple equipment. In this case, the science content knowledge on the theme "deoxyribonucleic acid" (DNA) was being improved using the context of solving crime. For instance, in order to understand how human beings came into being (from the perspective of science) one needs to understand the topic of DNA (Goodyall, 2012). This might be fascinating to some and culturally and religiously unacceptable to others. Genetics, through the topic of DNA, makes it possible for children to understand their ancestral links and helps investigators to solve certain crimes (Goodyall op. cit.; Lynch and Hancock; 2012).

The following research questions were formulated to uncover these perceptions:

- What are teachers' perceptions of the subject content knowledge presented and the facilitation process?
- What are the teacher view on the facilitation process of the project on primary science day

In order to answer the research questions, we describe and make a distinction between perceived and implemented programme. Only one programme was implemented during the primary science day project. For the sake of clarity we make a distinction between the

implemented programme and the perceived programme as written by (Hartley, Treagust and Ogunniyi 2008). The implemented programme is the actual programme as implemented and observed by the researcher while the perceived programme is the same programme, but as perceived by the teachers who received it.

THE PRIMARY SCIENCE DAY PROJECT

In order to understand how were data collected and analysed for the primary science day project, it is important to distinguish the implemented programme from the perceived programme.

Description of the implemented programme

Implemented programme is the "primary science day project", that is, the programme as implemented from the perspective of the researcher and SAASTE, the project owner. The primary science day project consisted of two full-day teacher workshops and a Primary Science Day.

The project started with the identification of curriculum-based content knowledge around which a forthcoming workshop could be planned. Next, workshops where teachers could perform experiments related to the theme, in this case the "DNA Detective", were organised. This theme included DNA exploration, such as in paternity testing and crime investigation. Posters and kits were provided for use in the activities. Each science kit contained familiar substances such as a bottle of methylated spirits, a bottle of dish-washing liquid, wheat, a stick, and guides for both learners and teachers to be used in the activities. The teacher's guide equipped teachers with advanced knowledge about DNA as well as newspaper cuttings of DNA applications in different parts of the world to keep the teacher informed about related developments outside South Africa. The learners' guide contained worksheets for learners. The facilitator's role was to explain the content knowledge and activities where necessary.

The first activity performed during the workshops was about inheritance. This was done in order to give participants background knowledge of DNA. Activities that followed involved the extraction of DNA from wheat using some of the contents of the science kits. Other activities were guided by illustrations on the posters on how DNA could be used to solve crime and in identifying a child's parent. The purpose of these activities was to illustrate the

role of subject knowledge and the application of Science and Technology to solve problems in line with the Curriculum and Assessment Policy (CAPS) for the intermediate phase (Department of Basic Education 2011). It was essential for teachers to be able to link practical activities to theory as is advanced by (Munby, Cunningham and Lock 2000). Workshop activities took the form of group work with a view of exposing teachers to this learning approach so that they in turn could grant learners similar opportunities.

The project was piloted in 200 schools in Gauteng and Limpopo provinces. One or two Grade 6 and 7 teachers aged between 25 and 50 represented each school. Their teaching experience ranged from five to 30 years. The Primary Science Day (PSD) was arranged for learners whose teachers participated in the workshops. The Primary Science Day was dedicated to science-related activities to promote interest in science activities among learners. During the Primary Science Day, there were learners who were repeating the activities done at the teacher workshops, indicating that some teachers had replicated the activities with them. Other learners did their own innovative projects relating to biodiversity. Both the teacher workshops and the Primary Science Day activities were evaluated after a total of 400 schools had participated in the programme in Gauteng and Limpopo provinces.

Data collection techniques

During data collection with regard to teacher perceptions, participants were divided into two focus groups, each assigned a researcher. In total, 20 focus groups comprising of 8 to 12 teachers each were held in the two provinces combined. Throughout the interviews participants were allowed to talk freely and in some cases their answers covered more than one question. Thus follow-up questions depended on responses given. All interviews were recorded on an audiotape and transcribed verbatim.

Questions asked during the focus groups guided the formation of categories. Categories and patterns were based on the responses given by the interviewees. Categories addressed themes while the subcategories reflected sub-themes. Responses did not follow the sequence of questions in the interview schedule because participants spoke freely. For this reason it was necessary in the analysis of data to go through all responses and to match them to questions that were asked. This process was repeated within similar responses to identify further

detailed answers which were used to form subcategories. Another researcher checked the categories and subcategories of responses to ensure inter-coder reliability.

CONCEPTUAL FRAMEWORK

A modification of a conceptual framework for educational evaluation adopted by the International Association for the Evaluation of Education (Keeves 1972) and used by Hartley, Treagust and Ogunniyi (op. cit) guided the study. This theoretical framework distinguished between the implemented and the perceived programme. The benefit of this framework is that it clearly shows what programme was implemented and what kind of programme the participants would like to see.

As previously indicated, the implemented programme includes the actual activities and content knowledge of the workshop as implemented, while the perceived programme refers to the implemented programme as perceived by the teachers. The implemented programme is meant to provide a picture of actual activities that took place according to constructivist principles. The teachers' perceptions of the implemented programme were gleaned from focus group interviews with the teachers because they reflected what teachers perceive to be good or weak about they were learning from the workshops.

The activities incorporated teachers' familiar contexts in accordance with constructivist principles. These activities, in conjunction with the manual provided and explanations from workshop facilitators, addressed both the teacher content knowledge and pedagogical knowledge needs focusing on a chosen science theme (Méheut and Psillos 2004). The contribution of the primary science day project to professional teacher development was based on teacher reported perceptions of the workshop activities, content knowledge covered, and the ability of the teachers to transfer skills of applying natural sciences concepts to their learners.

METHODOLOGY

A qualitative approach was considered appropriate in order to obtain an in-depth understanding of participants' behaviour by putting this behaviour into their life context (De Vos and Fouché, 1998).

Data for the perceived programme was collected in two phases: the first was the "actual implementation of the programme" and the second took place when the programme was completed. For the implemented programme, data was collected through observations. Field notes were taken as activities progressed. The purpose of this data was to monitor whether the workshop progressed according to plan so that perceptions displayed for the "perceived programme" could be understood in that context. Teacher perceptions on the activities were collected after both the workshops and the Primary Science Day had taken place.

Ten researchers were involved in data collection in different focus groups. A focus group interview is "a purposive discussion of a specific topic or related topics taking place between eight to ten individuals with a similar background and common interest" (Schurink, Schurink and Poggenpoel 1998: 314). Purposeful sampling with the help of subject specialists employed by the Department of Education resulted in the selection of 400 disadvantaged (in facilities and teacher science qualifications) schools in the two provinces.

The purpose of the focus groups was explained to the participants and they were assured of confidentiality and anonymity and requested to be honest in their responses so that the purpose of the focus group could be achieved. When participants had given their informed consent to participate in the investigation, the focus groups which lasted for approximately 40 minutes were conducted. All focus group interviews were conducted at the workshop site, a place already familiar to the teachers, thus facilitating a relaxed atmosphere. A two-part interview guide was developed for use with the focus groups. The first part focused on the teachers' workshops, while the second part focused on the Primary Science Day. The thrust of the first part of the interview guide was the workshop content, general perceptions of the teachers about the workshop, and suggestions for improving the workshop. The thrust of the second part of the interview schedule featured teacher perceptions of learner activities during the Primary Science Day and recommendations on improving future primary science days. In analysing the data, my familiarity with the teachers' background and religions enabled me to consider conditions such as religion, culture and economy which could affect our interaction. Indeed, these two conditions as well as the poor education received due to the political circumstances of their era affected responses received (Corbin and Strauss, 1996). To ensure the trustworthiness of the study, verisimilitude was applied.

FINDINGS AND DISCUSSION

The findings of the perceived programme are discussed below.

Teachers' perceptions of subject content and activities

The majority of the participants had positive perceptions of the content knowledge covered in the workshop. There were, however, isolated cases where participants were not happy with the context in which the content knowledge was used. There were many excerpts from transcripts to illustrate these views but only one will be used for each different view when a cluster of transcripts reflects one view. The quotations are presented verbatim.

Subject content knowledge

The content knowledge was found to be relevant to the curriculum:

> The content was relevant to the age group of the learners, more especially the grade 7s because it is with them now we were looking at the biology part because the workshop was looking at the DNA extraction.

The subject content related directly to the "Life and Living" part of the curriculum:

> The content was curriculum based because it was looking at DNA extraction whereby it falls under the biology part of our science and technology.

The excerpts above show that the issue of relevance was linked to the materials addressing the Life Sciences part of the curriculum.

Overall, the excerpts show that the teachers accepted the content as relevant and suitable for the level of learners. However, for some, the level at which the content was pitched, although perceived to be high, posed no problem when they had to facilitate learning:

> The level of the content was high but I could adjust it to the level of the learners.

This perception of the level of content can be seen as 'neutral'. While some may see the above view as negative from the point of view of the learner level, it may be seen as positive considering that the workshops were conducted for teachers and not for learners.

A Grade 7 teacher was concerned about the level of the content:

> I want to say the content was above the standard of Grade 7s.

For some teachers, negative perceptions arose from their differing existing plans:

> We didn't plan for that in our grades. It was not included in the year plan.

The above views show that the teachers were either inflexible in their plans or are not independent enough to incorporate into their programmes what they considered to be important.

Culture and religion also appeared to affect perceptions:

> For most of our black learners, they don't know that children are made through this but you know this in our homes whereby the children come from God.

According to the abovementioned view, the concept of DNA is contradictory to the religious and cultural views of creation. From a religious perspective, children's knowledge is limited to the belief that children are created by God while, culturally, childbirth is never talked about in the presence of children. This comment shows that there is a need to address the effects of cultural issues in the learning of science. This matter was not addressed in this workshop. The Department of Education has allegedly not given teachers permission to teach this topic:

> … if you look at our schools, we don't have sex education and then the government has not yet allowed us to teach that subject at our school.

The view expressed above may have its origin in difficulties about determining how far one should take the concept of DNA with learners and what sex education means. In this teacher's understanding sex education was not in the curriculum. The association of this problem with sex education may have to do with how the subject should be approached, thus highlighting the importance of cross-cultural teaching strategies (Aikenhead 1997).

Looking at the different excerpts above, it appears that while different focus groups saw the content as relevant, there was no consensus on whether it could be used in the teaching of

biology in the primary school. While some focus groups had the perception that it could be used, other focus groups had the view that this could not be done although in one case it was expressed that the level could be adjusted to that of the learners.

Facilitation process

The facilitation process entailed practical work where participants were actively involved. Only positive perceptions were reported about the facilitation process. These perceptions complement positive perceptions of the subject content and workshop activities.

The workshop was seen to be putting theory into practice and was thus perceived as being interesting:

> I think the content of the workshop was interesting in the sense that we did most of the things practically.

The quote provided above shows that the hands-on nature of the workshop elicited interest. Another source of interest arose from the simple materials used in the activities:

> The content was very much interesting I did think, I for one … I wasn't aware that you can use soap and simple materials like wheat and sunlight liquid soap in order to make such an experiment.

The above comment suggests that, after the workshops, teachers became aware that simple everyday materials can be used in performing experiments.

Participant involvement in the teaching-learning process which they needed in their classes was appreciated:

> I feel very much happy about the contents of the workshop because since now we are busy with the new curriculum, which caters a lot of learner involvement in the lessons. So with the workshop there were more of learner [teachers in this workshop] involvement because there were enough and relevant materials which were used

Finally, teachers showed positive perceptions towards science when they realised that science was being applied in their everyday life:

We managed to get new information and we also realised that science is not a strange thing, we live it in our everyday lives … and it also helped us to explore and to know and to get more knowledge about our daily lives.

By using simple everyday materials the facilitator helped to create good perceptions:

I think the facilitator was absolutely good because she gave out different kinds of examples which we can approach the science and technology lessons. Using cheap and simple materials and then she also gave us different kinds of activities using one thing.

From the above, it is clear that the workshop, in line with policy as stated in CAPS Grades 4-6 (specific outcome 3, intermediate phase) and the Natural Curriculum Statement (Learning Outcome 3, Grade 7) broadened the teachers' subject content knowledge and application of science.

For some teachers everything about the workshop was good and they wished more time could be allocated:

All I can say, the time, which was given, I think it was very short.

The comment above gives an overall perception of the workshop: some teachers had positive perceptions of everything covered in the workshop and wanted more time to learn more. However, other teachers expressed negative perceptions of the workshop.

Overall, it can be seen that findings regarding the subject content covered in the workshop show differences of opinion on the issue of relevance to age, curriculum and interpretation of level. Some teachers felt that the level at which content was presented to them should be at the level of their learners. Other teachers accepted that content may be presented to them at a level higher than the one they were going to teach at. It would then be their responsibility to adjust it to the level of learners.

The historical background of South African education may explain some of the above differences. When education in South Africa was still segregated along racial lines, black student teachers, in contrast to their white counterparts, received content knowledge no

higher than that of the learners they were going to teach (Mudau, 2017). It is thus not surprising that some teachers who were trained during that era, expected to learn at the level of learners.

Despite some negative feelings, the teachers were generally happy with the knowledge and presentation skills of the facilitators. They were exposed to different kinds of activities using local materials and were therefore empowered.

Teachers' perception on how the workshops impacted on their skills

Teachers felt empowered and indicated that their knowledge had been enriched by the workshop:

> I for one I wasn't aware that it is possible that me as a person I can do DNA extractions. I was thinking it is only done at laboratory levels or it is only done by special people but I was very much amazed that I can do DNA extractions.

The teacher was thus enriched by the ability to perform experiments they had previously considered impossible without a sophisticated laboratory. In terms of classroom practice, teachers were empowered by teaching approaches:

> It did help me to reach my curriculum objectives because at first I wasn't clear of how to approach such a kind of a lesson but because of the simple materials that I got from the workshop, it was very easy to can approach and implement the experiments in the classroom.

Teachers indicated that they had gained confidence about their grasp of science and technology after attending the workshops:

> … we were afraid of science and technology. But now from now, I think things would be easier after the workshop.

It can be seen from the above that the workshops helped to build confidence among teachers by exposing them to simple technology. The Primary Science Day was held after the workshops were conducted.

CONCLUSION

The findings show that the positive perceptions by teachers are in line with an INSET programme. Indeed, the teachers identified the short duration of the project as a limitation, and they recommended that the duration be increased.

These findings show that a focus on a science theme, presented through enjoyable activities related to an everyday context can leave teachers with confidence to teach and positive perceptions of what they learned. It was possible to instil interest in practical work among learners and teachers through relevant activities and innovative teaching approaches, using simple and familiar equipment. Teachers who previously were not confident to perform practical work developed the confidence and encouraged their learners to perform experiments.

It emerged from these findings that interest in practical work acquired through the workshop is not necessarily connected to the perceived relevance of the subject content covered. Despite conflicting views regarding the perceived relevance of the subject content, all teachers agreed that the content and activities were interesting. A small minority thought the theme was not relevant because it was presented at a level higher than that of their learners. Many thought the level of presentation was suitable for teachers and the theme was relevant.

Conflicting views regarding the relevance of content are indicative of the extent to which content itself is problematic. This highlights the need for emphasis on content for teachers participating in INSET programmes as well as on the methodology of presenting the content to the learners. On the whole, teachers had positive perceptions of the workshop. The project made a contribution to teachers' content knowledge of the concept in question as well as their teaching approach. The paper concludes that what remains to be seen is whether teachers can apply skills learned from a workshop to other themes in the curriculum.

The findings of the study reported in this article suggest that teachers will perceive workshops to be successful if the following strategies are used:

- Getting them actively involved during inset in a teaching approach which they themselves are expected to use as teachers;

- Relating a chosen theme to everyday context. This encourages teachers as it shows the relevance of the subject content in everyday life;

- Using everyday simple equipment. This approach motivates teachers as they realise that science has an application in the everyday activities they encounter;

- Improving teachers' content knowledge, and approaches to present the content at the level of learners. There is a need to strike a balance between the content knowledge required and teaching approaches.

ACKNOWLEDGEMENTS

REFERENCES

Aikenhead, G.S. (1997). Towards a first nations cross-cultural science and technology curriculum. *Science Education*, 81(2), 217–238.

Chuene, K.M. (1997). Perceptions of pre-service and novice teachers on mathematics teaching. In Kelsall P and De Villiers M (eds). Third National Congress of the Association for Mathematics Education of South Africa. 7–11 July, Natal University.

De Vos, A.S., & Fouché, C.B. (1998). General introduction to research design In De Vos AS (ed). *Research at grass roots.* 1st edition. Pretoria: Van Schaik.

Department of Basic Education. (2011). *Natural Sciences and Technology Curriculum and Policy Statement Grades 4-6*. Government Printing Works.

Desimone, L., Garet, M.S., Birnam, B.F., Porter, A., & Yoon, K.S. (2003). Improving teachers' in-service professional development in mathematics and science: the role of postsecondary institutions. *Educational Policy*, 17(5), 613–649.

Germann, P.J. (1994). Testing a model of science process skills acquisition: An integration with parents' education, preferred language, gender, science attitude, cognitive development, academic ability, and biology knowledge. *Journal of Research in Science Teaching*, 31(7), 747–783.

Goodyall, H. (2012). So where do we come from? Genetic heritage and reconstruction. HSRC Seminar, 21 September 2012. Pretoria.

Hartley, M.S., Treagust, D.F., & Ogunniyi M.B. (2008). The application of a CAL strategy in

science and mathematics for disadvantaged Grade 12 learners in South Africa. *International Journal of Educational Development,* 28, 596–611.

Jita, L.C., & Ndlalane, T.C. (2009). Teacher clusters in South Africa: Opportunities and constraints for teacher development and change. *Perspectives in Education*, 27(1), 58-68.

Keeves, J.P. (1973). IEA science project: Science Education in three countries – Australia, the Federal Republic of Germany, the United States. *Implementation of Curricula in Science Education*, 158-178.

Lynch, V., & Hancock, C. (2012). Solving Crime with DNA. *Quest*, 8(2), 3-9.

Méheut, M., & Psillos, D. (2004). Teaching-learning sequences: aims and tools of science education research. *International Journal of Science Education*, 26(5), 515–535.

Mji, A., & Makgato, M. (2006). Factors associated with high school learners' poor performance: a spotlight on mathematics and physical science. *South African Journal of Education*, 26(2), 253-266.

Mudau, A.V. (2017). Classroom practices as indicators for science content knowledge problems: the case of projectile motion*, Dirasat: Educational Sciences*, 44 (4), 359-370

Munby, H., Cunningham, M., & Lock C. (2000). School science culture: A case study of barriers to developing professional knowledge. *Science Education*, 84, 193–211.

Reddy, V. (2006). Mathematics and Science achievement at South African schools in TIMSS-2003. Cape Town: HSRC Press.

Schurink, W.J., Schurink, E.M., & Poggenpoel, M. (1998). Focus group interviewing and audio-visual methodology in qualitative research. In De Vos AS (ed). *Research at grass roots*. 1st edition. Pretoria: Van Schaik.

Taylor, N., & Vinjevold, P. (1999). Getting learning right. *Report of The President's Education Initiative Research Project*, Johannesburg: The Joint Education Trust.

Verschaffel, L., De Corte, E., & Borchart, I. (1997). Pre-service teachers' conceptions and beliefs about the role of real-world knowledge in mathematical modelling of school word problems. *Learning and Instruction*, 7(4), 339–359.

COLLABORATIVE GOVERNANCE AND CRISIS MANAGEMENT IN NIGERIAN UNIVERSITIES: AN EXPLORATION OF STUDENTS' ACTIVISM

Bunmi Isaiah Omodan, Bekithemba Dube & Cias T. Tsotetsi
University of the Free State
OmodanBI@ufs.ac.za

Abstract

The study examined collaborative governance in correlation with the management of students' oriented crisis in Nigeria universities. The study adopted a descriptive research of survey design. The population is delimited to the public universities in Nigeria. Multi-Stage sampling procedure was adopted to select the sample, first stage include the selection of two states in each of the geo-political zones using simple random sampling, the second stage involved the selection of two universities from each zones using simple random sampling, and the third stage involved the selection of 120 participants. 10 participants comprises of both student leaders and member of universities management were selected from each of the selected universities using convenient sampling. The instruments used for data collection was questionnaire tagged Collaborative Governance and Management of Students' Crisis Questionnaire (CGMSCQ) designed to collect information from management staff and student leaders. The instrument was validated for necessary modification and test-retest method was used to determine the reliability of the instrument. The research question was answered using simple frequency count and percentage. Hypotheses 1 to 3 were analyzed using Pearson Product Moment Correlation while hypothesis 4 was analyzed using regression analysis. All hypotheses were tested at 0.05 level of significance. The study revealed that the level of collaborative governance in managing crisis in Universities was moderate, the study also found out that there is significant relationship between the variables of collaborative governance and management of crisis where consensus building stands the best predictor of crisis management. Collaborative governance (Consensus Building and Facilitative leadership) is therefore recommended to be encouraged among universities to enable them reduce the tension of student crisis in the system.

Keywords: Collaborative governance, Crisis management, Consensus building, Facilitative leadership, Student activism.

Introduction

Education as a social phenomenon does not exist in isolation; in essence, education is life. The importance of Education cuts across all levels and spheres of society. It originates from the family, which is one of the social institutions responsible for the primary education of a child; and later, the schools where the child acquire the major substance of educational development. The type of education instilled into a child determines who the child becomes eventually and this chemistry between education as a social doctrine and a child, to a great extent, affect the society at large. Therefore, a society or an organization bereft of educated people and good education values is destined for chaos and disarray. This is an indication that education occupied a very significant developmental vacuum in nation building, that is, education is unavoidable industry that cut across innermost fabric of human endeavour (Otonko, 2012).

It should be noted that educational institutions such as Universities are lucid miniature of micro-societies where the roles and influences of education can be investigated; whether as an agent of development or otherwise. University system which is the concerned target for this article, is an important form of education vested in human capital development which is very significant to economic growth in any society (Blaike, 2002). Universities contribute to both internal and external sustainability, internal sustainability such as policy formulation and implementation, campus and environmental initiatives, curricula and research development, external sustainability also includes universities' roles in its regional environment (Otonko, 2012; Yuan, Zuo & Huisingh., 2013). Therefore, university education system is an iota of sustainability to both itself and the entire society. Thus, the position of universities as an agent of transformations and creation of sustainable society according to Beynaghi *et al.* (2016) are acknowledged and envisioned. This sustainability tenet in my view could only be achieved when the structures put in place in the system are able to operate without obstructions.

In every effective university system, there are technical structures put in place to deliver on its objectives. The structures consist of the Governing Council and the Senate. The Governing Council is regarded as the highest administrative body in the university predominantly set up to perform general management functions such as; supervision and

control of the university's affairs, policy formulation, and funding of the system (Ogbomida, Obano & Emmanuel, 2013). The governing council is headed by the chairman usually appointed by the state governor in case of state university or the president of the country in case of federal universities in Nigeria.

The second arms of university administrative system in Nigeria is the Senate which is regarded as the highest academic authority in the university. Ibukun (1997) describes it as the main organ regulating the internal activities of the university. It makes and implements academic programmes, moderate examinations, direct teaching and research activities. The Senate is headed by the Vice-Chancellor who is the chief executive officer charged with both administrative and academic responsibilities. Other members of the Senate according to Ogbomida, *et al*. (2013) are the deputy Vice-Chancellors, the Registrar, the Deans of Faculty and Provosts, Heads of Departments, Directors of Institutes and Centres, The Librarian, all professors and nominated members from the Congregation.

This structure is put in place to be able to actualize the aims of high education in Nigeria with which university is not an exemption. Part of the aims according to Federal Republic of Nigeria (2013) is to; contribute to national development through a productive manpower training for political, economic and social development, develop proper values for the survival of the individual and society, acquiring of both physical and intellectual skills for self-reliant in the society and promotion of national unity. Therefore, the relevance of university education in Nigeria lies in the provision of much needed manpower to accelerate the socio-economic development of the nation because such higher level of education is an instrument of social change and economic development (Ajayi & Ekundayo, 2012).

Overview of Student Activism cum Crisis
Students' activism in Nigerian universities is one of the factors that is responsible for both success and otherwise of the system because students as one of the intellectual stakeholders appears to be the reason while the university system came to existence. From the historical observations, marginalized, maltreated and underrepresented students have not been leaving any stone unturned in expressing their displeasure through agitations, strikes and various forms of crises against the management of the universities. This according to Fisher (2018) emanated through civil rights movement and the Higher Education Act of 1965 which gave

birth to the first Black Student Union (BSU) in 1966 with predominant purpose of demanding an acceptable environment for black students in United States America.

Meanwhile, the history of students' activism in Nigeria is traceable to poor living conditions for students such as; lack of infrastructure in schools, hike in school fees, on the part of tertiary institution management and draconian policies on the part of the governments (Chiamogu, 2016). Though students' activism is thus a legitimate means for students of Nigerian universities, and other tertiary institutions to champion and press home their interests towards achieving better learning successes, fair and just societies and good governance (Chiamogu, 2016; Punch, 2016). But its consequences usually result to crisis. This reflected in the conclusion of Aluede (2001) that students oriented crisis is seen as a common phenomenon in institutions of higher learning since independence.

Students' crises through activism phenomenon has come to be a receiving socio-political problem in Nigerian history (Davies, Ekwere & Uyanga, 2015). This is evidence in manifestation of students' crises on campuses, wanton destruction of academic calendar among others (Falua, 2004). Some of the most striking ones include the 1971 crises at the University of Ibadan, 1978 crisis at the University of Lagos which extended to other universities, 1992 crises at the University of Ibadan, 1999 students' crises at the University of Ado-Ekiti and 2001 crises at Federal University of Technology, Akure (Akinyemi, 2002). Lagos State University 2002 crisis over brutal murder of a union leader, Ebonyi State University, 2004 crisis over bad road leading to Ishieke campus, University of Lagos crisis in 2016 as a result of increase in school fees, University of Ibadan also went on protest to agitate for reduction in their school fees in 2017 which also let to the closure of all academic activities by the Vice chancellor of the university and Ladoke Akintola University also witnessed student's unrest in resent time as a result of inadequate funding which led to the indefinite closure of the university (Daily Post, 2017; Premium Times, 2017).

Collaborative Governance
The above listed problems in university system in Nigeria may not be unconnected to whether or not the university management recognizes the importance of collaborative management styles for the purpose of ensuring relative peace in the system. Collaborative governance according to Donald (2004) involves the collaborative efforts of government,

community and private sectors relating with one another to achieve more than any one sector could achieve on its own. Collaborative governance covers both the informal and formal relationships among the stakeholders such as public, private and community sectors in making decision and solving problems through support, leadership and a forum (Quintin, 2012). That is, the support is a process to identify policy problem that needed to be rectified, the leadership is a process to galvanize various sectors into a forum while the member of the forum collaboratively work together to develop policies, solutions and answers to the problems (Ansell & Gash, 2008).

In time past, managers, administrators and governors of public sectors like university system has been centered traditionally to the role of government in addressing public issues (Sarzynski, 2015; Shih, Latham and Sarzynski, 2016). However, the complexity and the interrelatedness of university education and its stakeholder's agitations and interests has given rise to the need for collaborative governance. This is supported by Shih, et al (2016) that public issues has extended the inquiry beyond the boundaries of the public sector and incorporated other sectors, such as businesses and local communities. This is evidenced in the work of Lemos and Agrawal (2006) and Sarzynski (2015) who investigated the linkages among the actors comprising all organizational networks and its effects on the governance of public or societal issues, their reports showed that there is significant relationship between collaborative efforts and effective governance.

It seems administrators in the universities have neglected the power of collaborative effort of both internal and external stakeholders in maintaining peace and tranquility most especially on cacophony emanated from student activism. Meanwhile, Public administrators should at this time begin to recognize the linage among the people, the private sector and the government (Wikipedia, 2018). Although, this does not take away the bureaucracies principles in the organization but public administrators expediently need to recognize collaboration because many could potentially be achieved by consensus building and networks (Morse, & Stephens, 2012). Even facilitative leadership will not be an exception.

Consensus Building as Indices of Collaborative Governance
Consensus building as one of the indices of collaborative governance is process of resolving conflicts mainly when it's a complex, multiparty disputes which originated since 1960 and

since then attracted scholars, managers and governors in the field of environmental and public policy (Burgess & Spanglar, 2003). It is a kind of approach that is needful most especially when multiple parties or groups are involved in a complex disagreement (Susskind, 1999). The process involves in building consensus give room for all the stakeholders involved to work together and develop a generally and mutually acceptable solution by making collective plans, solve problems, develop recommendations, or make decisions cooperatively, rather than in isolated, competitive, or confrontational manner (Malek, 2013). That is, a consensus building as an approach to managing crisis is a collective means of solving problems with equal participation or representatives of all the necessary parties that have stakes in the conflict. This is why Malek (2013) concluded that participants in such gathering make effort to unanimously meet the interests and agitations of all participants and thereby make plans, discussion and recommendation for everyone to live with.

Therefore, it become very important to build consensus among various parties involved in the running and management of university system because lack of consensus according to Ullah & Tamaki (2011) entails high disorder in epistemic sense. Meanwhile, it was observed that university system in Nigeria had either been insensitive to this type of approach or peradventure haven't seen the relevance of the approach to the management of students' crisis in the system. This is evidence in the observation of Akeusola, Viatonu & Asikhia (2012) and David (2013) that the use of administrative strategies such as participatory decision-making, committee system, dialogue among others could be productive. But it seems University authorities in Nigeria are not adequately implementing the suggested strategies, this is supported by the observation of Etadon (2013) that the alarming increase in students' crisis and vandalism at universities is mostly blamed on heads of institutions, because they lack adequate skills and knowledge required for checking and managing students' disagreement.

Facilitative Leadership as Indices of Collaborative Governance
Facilitative Leadership is another veritable variable of collaborative governance that also appears to be of great importance to the management of student crises in university system. Facilitative Leadership could be described as the behaviors that develop the collective ability of a school to adapt, to be able to solve problems, and to improve on organizational

achievement (Conley & Goldman, 1994). From this definition, it shows that facilitative leadership includes all stimulators of behaviors that helps the organization achieve shared, negotiated, or complementary goals (Dunlap & Goldman, 1991). From the forgoing, this aspect of collaboration in any organization and universities in particular is very important to ensure effective group relations, mutual interrelationship, flexible organizational culture towards managing conflict of any kind., This is supported by Smith (2003) that the facilitative kind of leadership is a people's oriented and people-centered, quality and results driven process of developing and supporting a culture in the workplace that facilitates serenity for goal achievement through relational processes.

As expedient as facilitative leadership style looks like, the researcher's observations showed that university management or governors are not adopting this kind of styles in managing the crisis in the system as against the opinion of Omisore (2011) who stressed that the success of any institutional management depends to a large extent upon the character and roles of leadership. This is supported by the findings of Omodan (2016) which revealed that there was relationship between union's activism and leadership style of management of tertiary institutions in Ekiti State Nigeria. This according to him stressed the usefulness leadership styles in ensuring peace and tranquility in university system but various observations showed that institutions mostly are too autocratic in their operations. Since the management of universities are perceived to have preferred an autocratic approach to resolving issues with the unions as suffices in the findings of omodan (2016) likewise in the opinion of Ekundayo (2012) that the cause of conflict between the university managers and institutional unions is the high handedness of school administration. However, this is an indication that the kind of leadership adopted by university governors determine whether they enjoy an amiable and serene relationship with the other stakeholders in the system.

Theoretical Perspective of Human relation Approach

The growth of factories that led to industrial revolution in the late 1800 contributed to the development of various contestable methods of management practices to improving efficiency and organizational effectiveness. Among which is human relation theory of management. Human relation theory of management started as result of failure of scientific/classical management theory because the former had neglected the well-being of workers with priorities on financial reward as the only motivator for organizational

stakeholders to perform (Yacoub, 2016). Human relation movement as against the classical approach placed more cognizance on the people in the origination, by recognizing them in decision making process, by placing the welfare and development of employees as priority as well as the productivity. It also observed factors and conditions of service that motivated workers for better performance which revealed the significance of human and social factors (Safferstone, 2005). That is, people's need and feelings, perceptions and attitudes alongside with inter-personal and intra-personal relationships is deeply encouraged.

Elton Mayo, who was a professor at Harvard In the early 1920's, detected how important is the interaction, collaboration and relationships in the place of work and led a team of researchers to conduct an experiment on working conditions and social factors in Western Electric Company situated at Hawthorne plant United State of America (Mayo, 1933).These studies that is widely referred to as Hawthorne studies have significantly contributed to management and administrative theory (Lunenburg & Ornstein, 2012). The results of the experiment was productive because at every stages of the process there were significant changes in the productivity and employees felt that they are valued by the management because they were cared about and were part of the experimental group which make them felt that they had the freedom to make workplace choices (Mayo, 1945).

Human relation theory of management became prevalent and widely spread between 1940's to early 1950's, because it draws the attention and focus of managers to the importance of individuals and their roles in correlation to the success and productivity in organization (Plano et al 1978). This is why till today, Human relation has been made a general term to describe managers-subordinates interactions and relationship (Indabawa & Uba, 2014). This is also exemplified in the opinion of Stoner (1978) that good human relations is tent to take place when management and employees stimulates more and better work conditions. That is, employee morale is a great determinant of human relations in organization. From the forgoing, one could deduced that human relations approach made supervisors/management and employees relationships the most important aspect of management. This is so because it emphasized on the development of people through methods like clinical and social psychological training to be able to build collaborative and cooperative relationships between all stakeholders (Gomez & David 2002; Indabawa & Uba, 2014). Therefore, to create good human relationship in any organization, administrators, governors and leadership must be

able to know why employees act as they do and what social and psychological factors will be needed stimulate and encourage them for better relationship and productivity.

The theory assumed that employees (stakeholders) desire to be involved in the team that facilitates development and growth of an organization, and that when the managers and other authorities relates mutually with the sub-ordinates, when the sub-ordinates or employees' psychological desires are recognized, it will propel good human and acceptable human relations in the system (Stoner and Wandel, 1988). Part of the assumptions are the needs such as; belongingness, inclusiveness and recognition among other things which determines worker morale than physical conditions of work environments (Nwanko, 2014); Informal or formal social group within workplace such as team effort, social conformity and group loyalty determines individual and group behaviours; people develop affinity for one another in group that comprises individual with various affinities; employees are motivated by social and psychological needs coupled with economic incentives; Communication, power, manipulative influence authority devoid of autocracy are important therefore should be encouraged and developed in organisation (Moreno, 1953; Mayo, 1933).

The theory views human beings as individuals with individual differences in terms of psychological motivations, distinct and dynamic behavior which affects performances. That is why Oraemes (1997) emphasized that treating students in a humane manner increases effort to democratize the system and the practice in education organsation. Finally, Undie (2001) was of the opinion that a school administrators should always initiate steps to satisfy both motivational and psychological needs of organizational stakeholders for better productivity. The implication of this theory, as affirmed by Odionye (2014), is that the more frequent the interaction between any two groups, the greater the tendency to co-operate with each other.

Since universities are recognized body of knowledge consisting of many scholars including students with varieties of belief and wants. Crisis is inevitable but ability of the school management to control and manage it makes them effective. Therefore, every organisation should gear its devotion towards crisis management. When the management of these Universities base their style of leadership on staff-students oriented, convey the decisions and policies of the management to the staff and students, form collaborative governance

comprising all stakeholders, make use of consensus to solving issues, engage student in dialogue, and ensure student motivation as well as provision of student's personnel services (Nwanko, 2014:158). This is in turn will automatically ensure harmonious relationship between these parties towards achieving the goals and objectives of University system.

Therefore, this theory is unequivocally relevant to this study, it exemplified the importance of inclusiveness of stakeholders as panacea to smooth university operations because it helps to explain why the University administrators should recognize various democratic tools to effective collaboration, co-operation and relationship. If the students and their leaders, staff and other environmental stakeholders are recognized by using consensus, collaborative method, dialogue system, motivation with adequate participation in decision making most especially the issues that directly or indirectly concern their welfare, this will instill into them how significant they are to the development of the system. This psychological and situational motivation will in turn change students' behaviour to act responsibly thereby ensuring a peaceful environment devoid of crises.

In view of the above, collaborative governance shows to have various peaceful promises for organizations, most especially university system. This is born out of that fact deduced from the above literatures that if university system is govern with collaborative efforts could avoid all form of adversarial policy making, could also ensure democratic and inclusive participation, even it could also reduce threat to public management for the purpose of tranquility in the system. This is supported by the conclusion of Ansell and Gash (2008) collaborative governance encourages and engages stakeholders in productive discussions where public managers will developed more fruitful relationships with stakeholders collectively to provide solutions to problem bedeviling the system. Therefore, this study is proposed to test the correlational influence of collaborative system of governance vis-à-vis it influence of on crises management in the university system for the purpose of ensuring lasting peace and productive co-existence in the system.

Purpose of the Study
The study examined the nature, process and practices of crisis management and the level of collaborative governance in university system focusing on students' oriented crisis, with recourse to environmental politics involved or should be involved in the processes of

implementing the yardstick for the establishment of university education in Nigeria. The research particularly examined the relationship between collaborative governance alongside with its suggestible variables and test its influence on the management of student crisis with hope to provide a practicable solution to the problem of incessant crises in Nigerian Universities.

Research Question

1. What is the level of collaborative governance in management of student's crisis in Nigerian universities?

Research Hypothesis

1. There is no significant relationship between collaborative governance and management of students' crisis in Nigerian Universities.
2. There is no significant relationship between consensus building and management of students' crisis in Nigerian Universities.
3. There is no significant relationship between facilitative leadership and management of students' crisis in Nigerian Universities.
4. Consensus building and facilitative leadership will not jointly predict management of students' crisis in Nigerian Universities.

Methodology

The study examined management of students' crisis and the level of collaborative governance in university system with a view to providing a practical solution to the menace of student unrest in Nigeria. The study adopted a descriptive research of survey design. It is descriptive research because it describes the existing situation on management of student's crisis. It is survey design because it covers a wide range of scope in order to make generalization possible. The population is delimited to the public universities in Nigeria. Nigeria consists of six geo-political zones with at least six states in each of the zones with minimum of two public universities in each of the states. Multi-Stage sampling procedure was adopted, first stage include the selection of two states in each of the geo-political zones using simple random sampling, the second stage involved the selection of two universities from each zones using simple random sampling, and the third stage involved the selection of 120 participants. 10 participants comprises of both student leaders and member of universities management (both present and past) were selected from each of the selected universities using convenient

sampling. The technique is used because it is less time consuming as the subject is quick and easy to be approach. Hence, the main assumption associated with convenience sampling is that the members of the target population are homogeneous (Etikan, Musa & Alkassim, 2016). This technique is considered appropriate because it enable researcher to make use of participants who are easy or convenient to be approached (Alvi, 2016).

The instruments used for data collection was questionnaire tagged Collaborative governance and Management of Students' Crisis Questionnaire (CGMSCQ) designed to collect information from management staff and student leaders. The face and content validity of the instrument was ensured by experts in the School of Education Studies, University of the Free State, South Africa for necessary validation and modification. Test-retest method was used to determine the reliability of the instruments. The results of the two tests were correlated using Pearson Product Moment Correlation (PPMC) with reliability coefficient of 0.79 which implies that the instruments was highly reliable. The research question was answered using simple percentage, hypotheses 1 to 3 were analyzed using Pearson Product Moment Correlation while hypothesis 4 was analyzed using regression analysis. All hypotheses were tested at 0.05 level of significance.

Results

Research Question

What is the level of collaborative governance in management of students' crisis in Nigerian universities?

Table 1: Level of collaborative governance in management of students' crisis in Nigerian Universities

Level of collaborative governance	Frequency	Percentage
Low (10.00 -14.92)	11	9.2
Moderate (14.93-24)	101	84.2
High (24.10-40.00)	8	6.6
Total	120	100.0

Table 1 showed that 11 respondents representing (9.2%) of the total sample reported low of collaborative governance in management of students' crisis in Nigerian universities, 101 respondents representing (82.2%) indicated moderate level of collaborative governance while

8 respondents representing (6.6%) indicated high level of collaborative governance in managing students' crisis in Nigerian universities. Therefore, the level of collaborative governance in management of students' crisis in Nigerian universities is moderately in operation.

Testing of Hypotheses

Hypothesis 1. There is no significant relationship between collaborative governance and management of students' crisis in Nigerian Universities.

In order to test the hypothesis, scores on collaborative governance and management of students' crisis were subjected to statistical analysis involving Pearson Product Moment Correlation at 0.05 level of significance. The result was presented in Table 2

Table 2: Pearson Correlation of collaborative governance and crisis management in Nigerian Universities

Variable	N	Mean	SD	R	P
Collaborative Governance	120	19.51	4.59	0.624*	0.009
Crisis management	120	19.23	3.23		

*p<0.05

The result in Table 2 revealed that there is significant relationship between collaborative governance and crisis management in Nigerian Universities (r=0.624, p<0.05). The null hypothesis was rejected because the relationship between collaborative governance and management of students' crisis in Nigerian Universities is moderately high and statistically significant in a positive direction.

Hypothesis 2. There is no significant relationship between consensus building and management of students' crisis in Nigerian Universities.

In order to test this hypothesis, scores on consensus building and management of students' crisis were subjected to statistical analysis involving Pearson Product Moment Correlation at 0.05 level of significance. The result was presented in Table 3

Table 3: Pearson Correlation summary of consensus building and crisis management in Nigerian Universities

Variable	N	Mean	SD	R	P
Consensus building	120	10.12	2.66	0.496*	0.001
Crisis management	120	19.23	3.23		

*p<0.05

Table 3 showed that there was statistical significant relationship between consensus building and crisis management in Nigerian Universities (r=0.496, p<0.05). The null hypothesis was rejected because the relationship between consensus building and management of students' crisis in Nigerian Universities is moderately high and statistically significant in a positive direction.

Hypothesis 3. There is no significant relationship between facilitative leadership and management of students' crisis in Nigerian Universities.

In order to test this hypothesis, scores on facilitative leadership and management of students' crisis were subjected to statistical analysis involving Pearson Product Moment Correlation at 0.05 level of significance. The result was presented in Table 4.

Table 4: Pearson Correlation summary of facilitative leadership and crisis management in Nigerian Universities

Variable	N	Mean	SD	R	P
Facilitative leadership	120	9.39	2.52	0.776*	0.002
Crisis management	120	19.23	3.23		

*p<0.05

Table 3 showed that there was significant relationship between facilitative leadership and crisis management in Nigerian Universities (r=0.776, p<0.05). The null hypothesis was rejected because the relationship between facilitative leadership and management of students' crisis in Nigerian Universities is moderately high and statistically significant in a positive direction.

Hypothesis 4. Consensus building and facilitative leadership will not jointly predict management of students' crisis in Nigerian universities.

In order to test this hypothesis (to predict which one of the two variables is better in managing student crises), scores on Consensus building and facilitative leadership were subjected to statistical analysis Multiple Regression Analysis at 0.05 level of significance. The result was presented in Table 5.

Table 5: Multiple Regression of Consensus building and facilitative leadership as predictors of crisis management in Nigerian universities

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	**Std. Error**	**Beta**		
(Constant)	13.305	1.005		13.235	.000
Consensus building	-.096	.131	-.141	-.733	.465
Facilitative leadership	.435	.130	.642	3.349	.001
Multiple R=0.517, Multiple R²=0.268, Adjusted Multiple R²=0.255, $F_{2,117}$=21.368, p=0.000					

*p<0.05

Table 5 shows that consensus building and facilitative leadership will significantly contribute to the management of students' crisis. ($F_{2,117}$=21.368[*], p<0.05). The null hypothesis is rejected. The table showed that there was significant positive multiple correlation between the predictor variables (consensus building and facilitative leadership) and management of students' crisis in Nigerian universities (r=0.517, p<0.01). The value of the coefficient of determination (r^2=0.268) indicated that all the variables of collaborative governance jointly accounted for 26.8% (r^2 X 100) of the total variance in crisis management in Nigerian universities while the remaining 73.2% unexplained variation was largely due to other variables not included in the model.

The regression result further indicated that the facilitative leadership (β = 0.891) was a better predictor of management of students' crisis in Nigerian universities than consensus building

($\beta = 0.141$). The multiple relationships between the dependent and independent variables can therefore be given as follow:

$Y = 13.305 - 0.096X_1 + 0.435X_2$

Where

Y =   Management of students' crisis

X_1 =   Consensus building

X_2 =   Facilitative leadership

Discussion

The study showed that the level of collaborative governance in management of students' crisis in Nigerian universities is moderate, this is an indication that the use of collaborative governance is actually in operation with average utilization i.e high priority is not placed on the use of collaborative governance in managing students oriented crises in university system in Nigeria. The study also revealed that there was significant relationship between collaborative governance and management of students' crisis in Nigerian Universities. This indicates that collaborative governance is one of the cogent factors that is necessary for managing students' crisis in university system. This findings justified the opinion of Ansell and Gash (2008) that collaborative governance is a process to identify policy problem that needed to be rectified, a process to galvanize various sectors into a forum while the member of the forum collaboratively work together to develop policies, solutions and answers to the existing problems. This is also in support of Shih, *et al.* (2016) that public issues has extended the inquiry beyond the boundaries of the public sector alone.

The Study also revealed that there was significant relationship between consensus building and management of students' crisis in Nigerian Universities. This means the use of consensus building will contributes positively to the management of student oriented crisis in University system. This is in consonance with the conclusion of Malek (2013) that participants in consensus building make effort to unanimously meet the interests and agitations of all participants and thereby make plans, discussion and recommendation for everyone to live with. This is also in support of the findings of McTague & Jakubowski (2013) that the adoption of consensus building will enable marginalized groups, the opportunity to actively participate in the creation of a plan in a just and equitable process for social victory.

The study showed that there was significant relationship between facilitative leadership and management of students' crisis in Nigerian Universities. This is in consonance with the findings of Omodan (2016) which revealed that there was relationship between union's activism and leadership style of management of tertiary institutions in Ekiti State Nigeria. This could be the reason why Owolabi (2010) concluded that personality is a powerful determinant of leader's effectiveness, followers' willingness to work and situational interaction to enable amiable relation in the system. This finding also justified the opinion of Omisore (2011) that the success of any institutional management depends upon the character and roles of leadership. The study also revealed facilitative leadership is a better predictor of management of students' crisis in Nigerian universities. This means that facilitative leadership was the most influential indicator that has a high impact in managing students' oriented crisis in university system. This is in line with the postulation of human relation theory of management that the attention and focus of managers should be to the importance of individuals and their roles in correlation to the success and productivity in organization (Mayo, 1933; Indabawa & Uba, 2014).

Conclusion

Based on the findings of the study, it was therefore concluded that collaborative governance is in existence within the ambient of universities but not adequately implemented most especially in managing student oriented crises of various dimension and magnitudes. Consensuses building and facilitative leadership as variable of collaborative governance are not only appropriate but also essential in the management of all kind of crisis in University system, therefore, should be enhanced.

Recommendations

Base on the findings and the respective discussion above, the following recommendations were made and if adequately implemented will enhance management of students' crises in university system:

- The government and the management of universities should place full and adequate importance to the use of collaborative government through the involvement of relevant stakeholders to the decision making process, most especially the one that concerns on how to ensure peaceful co-existence in the system.

- The university management should at all-time ensure the use of consensus building where students and other members of the origination are involve in the process of reaching a concessive agreement towards burning issues. And must be guided with principle of agreement to enable adequate implementation of respective consensus.
- Facilitative leadership style should be adopted by university managers where every stakeholders will be relevant and treated with almost equity and motivation devoid of autocracy.

Reference

Ajayi, I. A. & Ekundayo, H. T. (2012) Management of University Education in Nigeria: Problems and Possible Solutions. *Revitalization of African Higher Education.* 222-235. http://citeseerx.ist.psu.edu/viewdoc/

Akeusola O., Viatonu, O. & Asikhia, O. A. (2012). Perceived Causes and Control of Students' Crises in Higher Institutions in Lagos State, Nigeria. *Journal of Education and Practice,* 3 (10): 60-68.

Akinyemi, B. (2002). *Management of students' crisis in Higher Institutions in Ekiti State* Unpublished Med Thesis, University of Ado-Ekiti.

Aluede, O. O. (2001). Factors Influencing Student unrest in Tertiary Institutions in Edo State of Nigeria. *Educational Research Quarterly,* 24 (3); 10-26.

Alvi M. (2016) A Manual for Selecting Sampling Techniques in Research. *Munich Personal RePEc Archive.1-56.https://mpra.ub.uni muenchen.de.*

Ansell, C. & Gash A. (2008). Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory*, 18(4): 543-571

Beynaghi, A., Trencher, G., Moztarzadeh, F., Mozafari, M., Maknoon, R., Leal Filho,W., (2016). Future sustainability scenarios for universities: moving beyond the United Nations decade of education for sustainable development. *J. Clean. Prod.* 112, 3464-3478.

Blaike, A., (2002). *Recurrent Lessons in Nigerian Education*, Tamaza Publishing Company Ltd., Zaria.

Burgess, H. & Spanglar, B. (2003). Consensus Building. *Beyond Intractability.* https://www.beyondintractability.org/essay/consensus_building 16/05/2018.

Chiamogu, A. P. (2016). *Students Activism and Social Change in Nigerian Tertiary Institutions: A Call to Service*. A Lecture delivered at a Two-Day Leadership

Workshop for Newly Elected Students' Union Government (SUG), Executive, Legislators and Judicial Officers of Federal Polytechnic, Oko at the Mass Communication Conference Hall on December 6.

Conley, D. T. & Goldman, P. (1994). Facilitative Leadership: How Principals Lead Without Dominating. *OSSC Bulletifi*, 37(9). 1-52.

DailyPost Newspapers (2017). LAUTECH students protest, blast Aregbesola, Ajimobi over incessant strike. May 24, 2017.

David, A. (2013). Students' Crisis in Nigerian Tertiary Educational Institutions: A Review of the Causes and Management Style. *Khazar Journal of Humanities & Social Sciences*. 16 (1) 56-76.

Davies, K. U., Ekwere, G. E., & Uyanga, U. U. (2015). *Factors influencing students unrest in institutions of higher learning and its implications on the academic performance of students in universities of Uyo, Akwa Ibom State, Nigeria*. http://research.rs/wp-content/uploads.

Donald P. (2004) *Metropolitan Governance without Metropolitan Government?* (ed). Aldershot UK: *As*hgate Publishing.

Dunlap, D., & Goldman, P. (1991). Rethinking power in schools. Educational Administration Quarterly, 27(1), 5-29, EJ 421 302.

Ekundayo, H. T. (2012). Towards strengthening the relationship between trade unions and university management in Nigeria. *African Research Review*: *An International Multidisciplinary Journal. Ethiopia*. 6(2): 266-273.

Etadon F. I (2013), Campus Conflict Involving Students and University Management in Nigeria: A Case Study of the University of Ibadan; *International Journal of Education Science*. 5 (3), 333-343.

Etikan I., Musa S. A. & Alkassim R. A. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*. 5(1); 1-4.

Falua, B. T. (2004). *Management of students crisis in secondary schools in Ado-Ekiti Local Government Area of Ekiti State*. M. Ed Thesis, University of Ado Ekiti. Nigeria.

Fisher, M. T. (2018). Still fighting the good fight: An analysis of student activism and Institutional response. *Public Relations Review*, 44 (2018) 22–27.

Gomez M.B. & David B.B., (2002) *Management* McGraw Hill Companies, New York USA

Indabawa, S. l. & Uba, Z. (2014). Human Relations and Behavioral Science Approach to Motivation in Selected Business Organizations in Kano Metropolis Nigeria. *European Journal of Business and Management*. 6 (25), 168-174.

Lemos, M.C., Agrawal, A. (2006). Environmental governance. Annu. *Rev. Environ. Resour*. 31, 297–325.

Lunenburg, F. C. & Ornstein A. C. 2012. *Educational administration: Concept and practices*. (6th ed), USA: Linda Schreiber-Ganster.

McTague, C. & Jakubowski, S. (2013). Marching to the beat of a silent drum:Wasted consensus- building and failed neighborhood participatory planning. *Applied Geography*, 44. 182- 191.

Malek, C. (2013). Collaborative Problem Solving and Consensus Building. *Beyond Intractability. https://www.beyondintractability.org/coreknowledge/consensus-building/ 16/05/2018*

Mayo, E. (1933). *The human problem of an industrial civilization*. New York: Macmillan.

Mayo, E. (1945). *Social problems of an industrial civilization*. London: Routledge

Moreno, J. L. (1953). *Who shall survive?* New York: Beacon House

Morse, R. & Stephens, J. (2012). Teaching Collaborative Governance: Phases, Competencies, and Case-Based Learning. *Journal of Public Affairs Education*. **18**(3): 565.

Nwankwo, J. I. (2014). *Management in education: Modern approaches in educational management.* Ibadan: Giraffe Books.

Odionye C. M. (2014). Evaluation of crisis management strategies in selected universities in south-east Nigeria. M.A Dissertation, University of Nigeria, Nsukka.

Ogbomida, A. H., Obano, E.J. & Emmauel, O.O. (2013).Utilization of committee system in the administration of Nigerian universities. *Academic Research International*, 4(4), 392-399.

Omisore, D. (2011). Breached agreements: Threat to Management-Union Relationship. *Medwell Journals*. 6(4): 299-306.

Omodan B. I. (2016). *Influence of Trade Unionism on Management of Tertiary Institutions in Ekiti State*. M.Ed. Thesis, Ekiti State University, Ado Ekiti, Nigeria.

Oraemes; J. C. (1997) introduction to politics of Education. Port- Harcourt: Bengray

Otonko, J. (2012). University Education in Nigeria: History, Successes, Failures and the Way Forward. *International Journal of Technology and Inclusive Education (IJTIE)*, 1 (2). 44-46.

Premium Times (2017). University of Ibadan suspends student union leaders. May 30, 2017

Punch Newspapers (March 31, 2016). Violence is not student activism. Retrieved from http://punchng.com/violence-is-not-student-activism/ on December 5, 2016.

Quintin, B. (2012) A 'Performative' Social Movement: The Emergence of Collective Contentions within Collaborative Governance. *Space and Polity*. 16 (2): 215-232.

Safferstone, M. (2005) 'Organizational Leadership: Classic Works and Contemporary Perspectives', *Choice*, 42(6), 959-975

Sarzynski, A. (2015). Public participation, civic capacity, and climate change adaptation in cities. *Urban Clim*. 14, 52–67.

Shih, C., Latham, W. & Sarzynski, A. (2016). A collaborative framework for U.S. state-level energy efficiency and renewable energy governance. *The Electricity Journal*. 29: 21–26.

Smith, A. (2003). Facilitative Leadership. *Facilitation Training Inc. (Fti), Fogs Workshop April* 16, 2003. https://www.grad.ubc.ca/current-students/graduate-pathways-success/facilitative-leadership

Stoner, A.F & Wandel, C. (1988). Management. (3rd ed), India: Prentice Hall

Stoner, J.A.F (1978) Management, London: Prentice Hall International Inc.

Susskind, L. (1999) "An Alternative to Robert's Rules of Order for Groups, Organizations, and Ad Hoc Assemblies that Want to Operate By Consensus," in *The Consensus Building Handbook: A Comprehensive Guide to Reaching* Agreement, eds. Lawrence Susskind, Sarah McKearnan, and Jennifer Thomas-Larmer. Thousand Oaks, CA: Sage Publications.

Ullah,A.M, & Tamaki, J. (2011). Analysis of Kano-model-based customer needs for product development, *Syst. Eng*. 14 154–172.

Wikipedia (2018). Collaborative governance: Revision history. https://en.wikipedia.org/w/index.php?title=Collaborative_governance&action=history

Yacoub, M. (2016). The Influence of Classical and Human Relations Approaches in Management Today, A Critical Evaluation. Management Theories and Philosophies Module: University of South Wales https://www.researchgate.net/publication/311949526

Yuan, X., Zuo, J., Huisingh, D., (2013). Green Universities in China-what matters? *J. Clean. Prod*. 61, 36e45. https://doi.org/10.1016/j.jclepro.2012.12.030.

STUDENTS' PERCEPTIONS OF WRITING: EVIDENCE FROM UNDERGRADUATE ECONOMICS IN SOUTH AFRICA

Naiefa Rashied & Gorton Wilmans
University of Johannesburg, South Africa,

naiefar@uj.ac.za; gwilmans@uj.ac.za

Abstract

Thinking and writing economics can be an extremely daunting and difficult task, especially for undergraduate students. Few opportunities exist for students to apply their knowledge and write critically in the economics discourse, especially in their undergraduate years of study. With this in mind, the Nedbank and Old Mutual Budget Speech Essay Competition was launched in 1972 with the aim of encouraging young students to participate in important national economic debates. The competition is open to full time and part time undergraduate and postgraduate students from South Africa and SADC countries. A university department at a large residential university in the Gauteng province has instituted a system to encourage students to write the essay in small and regular intervals throughout the first semester of the year. Students are also provided with writing support outside of the classroom and a number of motivational talks are held to encourage students' participation and academic engagement. Despite the department's efforts, many undergraduate economics students choose not to participate in the competition. The aim of this study is to analyse students' perceptions of writing in order to understand why participation in the writing competition is so low. The study begins by exploring the literature related to the writing process, university writing and writing like an economist. Thereafter, the study briefly explains the model used to encourage writing among undergraduate economics students. Subsequently, the study's methodology is described and a univariate analysis is applied to survey data from the 2018 cohort of second and third year economics students. Results suggest that students struggle to synthesise large volumes of literature to form their own economic views. Furthermore, students seem to struggle with time management of essay writing amidst their busy academic timetables. The study provides some useful information on how the department could adapt its writing model to assist students to better manage the writing process and subsequently, encourage more meaningful academic engagement and greater competition participation.

Keywords: academic writing, undergraduate economics, students' perceptions

Introduction

Writing has long been identified as a process which yields a product (Murray, 1972 & Elbow, 1998). However, writing clearly and persuasively can be difficult mainly because the writing process itself is often intimidating and demotivating (Elbow, 1981). University or College students often experience this intimidation first hand, for a variety of reasons. Some students may be writing in a new language, other students may be struggling to integrate theory with their opinions, writing for a specific discourse may prove challenging or a lack of basic time management may hinder the writing process, among countless other challenges (Phakiti and Li, 2011).

As if the writing process was not perplexing enough, writing in the economics discipline at university-level comes with its own challenges (Brunnermeier, 2017). As aspiring economists, economics students are required to "think like an economist" and write using the "language of economic analysis" (Neugeboren, 2005). This involves clearly stipulating any underlying assumptions, outlining any underpinning theories, presenting relationships using mathematical equations and conducting empirical validations using different kinds of data, among rigorous analysis and discussion (Neugeboren, 2005 & Brunnermeier, 2017).

The writing process, thinking like an economist and convening a piece of writing using the language of economic analysis can seem daunting to many undergraduate economics students who have little writing experience and sparse engagement with economics discourse. In the South African context, Nedbank and Old Mutual launched the budget speech essay competition in 1972 in an attempt to encourage economics students to debate topical issues faced by the South African economy. While the competition receives about 20 000 essay entrants per annum, this is a small number of entries considering that the University of South Africa's economics department alone teaches 30 000 economics students per semester (University of South Africa, 2018).

A university department at a large residential university in the Gauteng province has instituted a system to encourage students to write the essay in small and regular intervals throughout the first semester of the year. Students are also provided with writing support outside of the classroom and a number of motivational talks are held to encourage student participation and academic engagement. Despite the department's efforts, many undergraduate economics students choose not to participate in the competition. The aim of

this study is to analyse students' perceptions of writing in order to understand why participation in the writing competition is so low.

The study begins by exploring the literature related to the writing process, university writing and writing like an economist. Thereafter, the study briefly explains the model used to encourage writing among undergraduate economics students at a large residential university in the Gauteng province. Subsequently, the study's methodology is described and a univariate analysis is applied to survey data from the 2018 cohort of second and third year economics students from this university. The results are discussed and used to provide useful recommendations to encourage more meaningful academic engagement and greater competition participation among undergraduate economics students at the university of interest.

Conceptual Framework

The Writing Skills System

A university department at a large residential university in the Gauteng province has instituted a system to encourage students to write the essay in small and regular intervals throughout the first semester of the year. The essay forms part of the curriculum of a formal subject and counts 10% and 20% of the semester mark for this subject for second and third year students respectively. Students are required to attend writing lectures once a week, for 12 academic weeks, where different aspects of writing in economics are addressed. The lecture is about 40 minutes long and takes place in the afternoon in a lecture venue or a computer laboratory, depending on the objective of the lecture and theme for the week. There is a writing tutor available to consult with students, individually or in a group, for up to 25 hours per week. The writing tutor is typically a postgraduate student, who has extensive writing experience. There were four motivational talks held to discuss aspects around competition entry, writing and general economics discourse.

The system used in the writing skills classes is process-driven, as opposed to product-driven, which is similar to Elbow's process (Elbow, 1998). Each lecture is based on a specific theme and involves the completion of an activity which contributes towards the essay gradually. Each weekly activity is generally quite different in order to hold the students' interest. Activities include mind maps, blog posts regarding current affairs (mainly economics and politics-related), shorter opinion-pieces on aspects of the essay and referencing practice

exercises, among other activities highlighted in table 1 below. Each activity is graded and students are provided with detailed feedback on each activity for reflective improvement purposes. Table 1 below outlines activities for 8 weeks, with the remaining 4 weeks used for additional student consultations.

Table 1: Writing skills **activity outline**

Week and theme	Second year activity	Percentage	Third year activity	Percentage
Week 1: An introduction to argument	Activity 1: Online discussion	10%	Activity 1: Online discussion	10%
Week 2: Essay planning	Activity 2: Mind map	10%	Activity 2: Mind map	10%
Week 3: Developing good arguments				
Week 4: One-to-one or group consultation				
Week 5: Acknowledging your sources	Activity 3: Referencing practice	10%	Activity 3: Referencing practice	10%
Week 6: Writing the body of your essay	Activity 4: Sub claim formulation	10%	Activity 4: Sub claim formulation	10%
Week 7: One-to-one or group consultation				
Week 8: Writing the introduction			Activity 5: Introduction	10%
Week 9: Writing the conclusion and using Turnitin			Activity 6: Conclusion	
Week 10: One-to-one or group consultation				
Week 11: Final essay	Final essay	60%	Final essay	40%
Week 12: Final essay feedback and final consultation before competition entry				

What Does Literature Say?

Literature suggests that writing should be process-driven (Elbow, 1998). Moreover, writing tasks should be aligned clearly with the discipline, sequentially with the curriculum and broken down into manageable and meaningful pieces that can scaffold each other (Beufort, 2007). It is also important to be mindful of transitions from secondary to higher education, both from a curriculum and writing perspective (Foster, 2017).

The writing skills system outlined in the preceding section is process-driven, in line with Elbow (1998), curriculum-aligned and presented in smaller pieces, in line with Beufort (2007), and grounded in writing theory, more specifically, the Toulmin model (Toulmin, 1958). The Toulmin model is a method of reasoning which involves three essential parts – the claim, the grounds or evidence (comprising of the data, qualifier and rebuttal) and the warrant (Wentzel, 2011). Toulmin (1958) outlined that a good argument should begin by explicitly stating the claim, shown as *C* in figure 1 below, otherwise known as a viewpoint. This claim should be supported by facts or evidence, referred to as data, *D*. *D* can take an empirical or non-empirical form. The relevance of the data with respect to the claim is then explained clearly and this is called the warrant, *W*. The warrant is critical because it is the reader's explanation of their viewpoint. The extent to which the claim can be accepted is then rigorously critiqued and this is called the qualifier, *Q*. The qualifier is usually used to constructively validate or invalidate the viewpoint based on all the available evidence. Lastly, the counterview, also called the rebuttal, *R*, is then explored. The rebuttal can focus on the claim, the data or the warrant and takes into account opposing views.
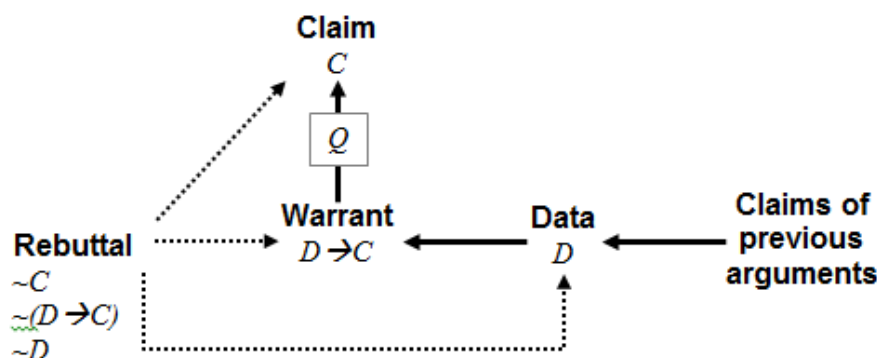
Figure 1: Graphical Toulmin Model from Wentzel (2011)

When students are constructing the main part of their essay, known as "the body" of their essay, the Toulmin model is used as a guide to help them formulate their views systematically. Since the Toulmin model itself is a process, students are encouraged to take one claim from their essay and use the Toulmin model to transform their claim into a concise, meaningful paragraph. The budget speech competition essay is usually about 2500 words in length and this translates into about five or six claims within the essay, over and above the introduction, conclusion and references. Students gradually build up each claim throughout the semester and receive feedback on the clarity and quality of their claims. Each activity is accompanied by a rubric, which provides clear writing guidance and rigorous feedback to each student. Table 2 below outlines one of the rubrics used for a weekly activity on claims.

Table 2: An example of a rubric used for a weekly activity on claims

	Good (2 – 3)	**Mediocre (1 – 1.5)**	**Weak (0 – 0.5)**
Claim	1. The sub-claim is clearly stated at the beginning of the paragraph. 2. The sub-claim is clearly connected through argument to make up bigger claims, until the thesis is reached.	1. The sub-claim is partially stated at the beginning of the paragraph. 2. The sub-claim is partially connected through argument to make up bigger claims, until the thesis is reached.	1. The sub-claim is not stated at the beginning of the paragraph. 2. The sub-claim is not connected through argument to make up bigger claims, until the thesis is reached.
Data	3. Empirical evidence is used to derive the sub-claim. 4. Claims are logically derived from given facts or axioms (deduction).	3. Empirical evidence is partially used to derive the sub-claim. 4. Claims are partially derived from given facts or axioms (deduction).	3. Empirical evidence not used to derive the sub-claim. 4. Claims are not derived from given facts or axioms (deduction).
Warrant	5. The link between the data and the claim is explicit. 6. Linking words are used throughout the paragraph to strengthen the connections.	5. The link between the data and the claim is partially explicit. 6. Linking words are sometimes used throughout the paragraph to strengthen the connections.	5. The link between the data and the claim is not explicit. 6. Linking words are not used throughout the paragraph to strengthen the connections.
Qualifier	7. There is an expression	7. There is a partial expression of the degree	7. There is no expression

	of the degree of certainty.	of certainty.	of the degree of certainty.
Rebuttal	8. A counterargument to the claim, warrant or data is identified. 9. Concession or refutation to the counterargument is clearly made.	8. A counterargument to the claim, warrant or data is partially identified. 9. Concession or refutation to the counterargument is partially made.	8. A counterargument to the claim, warrant or data is not identified. 9. Concession or refutation to the counterargument is not made.

Source: Rashied (2017)

Methodology

In May 2018, members of the writing skills team wanted to examine second and third year students' perceptions of writing. More specifically, the team was interested in the factors that hindered undergraduate writing. Thus, a voluntary questionnaire was issued in the writing skills lectures and students were encouraged to anonymously share their experiences of the writing skills system. Some of the questions were open-ended while others were either likert or binary-type questions. The questionnaire consisted of a comprehensive informed consent clause and students were sufficiently briefed on the purpose of the study. The questionnaire satisfied all the ethical clearance requirements of the residential university where students were surveyed.

The lecturer was not permitted to discuss aspects of the questionnaire with the participants. Students were free to leave their completed questionnaires in a folder after class at the back of the venue. The study made use of a descriptive research design and the questionnaire issued to participants contained 15 questions. Table 3 below outlines the structure of each question:

Table 3: Survey questions and answer structure

Question	Answer structure
1. How useful were the writing skills lectures?	Participants could choose from three options: not useful, somewhat useful or extremely useful.
2. Provide a brief reason for your answer.	Open-ended: participants were provided with 4 lines of space to respond.
3. How did you go about writing your essay this semester? Did you follow the structure provided in class (weekly activities) or did you use another structure? If you used another structure,	Open-ended: participants were provided with 4 lines of space to respond.

please tell us more about this structure.	
4. What was missing from the writing skills lectures? You may select more than one option.	Participants could choose from five options with 4 lines of space to elaborate: tips on how to manage reading large amounts of information, tips on how to summarise and synthesise large amounts of information, tips on how to begin thinking for an essay, the research process or other (please elaborate).
5. What did you like about the writing skills sub-module?	Open-ended: participants were provided with 4 lines of space to respond.
6. What did you dislike about the writing skills sub-module?	Open-ended: participants were provided with 4 lines of space to respond.
7. What more can we do to support you with your writing?	Open-ended: participants were provided with 3 lines of space to respond.
8. Did you make use of the writing tutor?	Participants could choose from two options: yes or no.
9. If yes, what exactly did the writing tutor assist you with? If no, why did you not make use of the writing tutor?	Open-ended: participants were provided with 4 lines of space to respond.
10. Was the writing tutor helpful?	Participants could choose from two options: yes or no.
11. At any point, did you struggle to understand what your lecturer was saying? If yes, what exactly did you struggle with?	Participants could choose from two options with 4 lines of space to elaborate: yes or no.
12. Do you struggle to read in English?	Participants could choose from two options: yes or no.
13. Do you struggle to write in English?	Participants could choose from two options: yes or no.
14. Did you attend any of the Budget Speech Competition Motivational Indabas?	Participants could choose from two options: yes or no.
15. If not, why did you not attend any of the Budget Speech Competition Motivational Indabas?	Participants could choose from three options with 3 lines of space to elaborate: too busy studying, Indabas were scheduled at inconvenient times or other (please elaborate).

Source: Authors' own adaptation

Based on the validity criteria specified by Sullivan (2011) - mainly content and response process in this instance - the questionnaire used in this study is sound. In terms of the content, the questions were developed by the lecturers interested in ascertaining whether students in the course experienced any writing challenges. Moreover, the student responses matched the questions.

Non-probability sampling was applied in this study as survey responses were voluntary. Out of approximately 190 enrolled second year students and 301 enrolled third year students, 51 second year students and 82 third year students volunteered to participate in this study by completing the questionnaire. Responses to each questionnaire were processed and all responses were collectively used to conduct a descriptive analysis of each question. The data does not contain enough general demographic information over time, such as age, race, academic performance, schooling quintiles and home language, to conduct meaningful bivariate and multivariate analyses. Nevertheless, the univariate analysis does provide a useful starting point for measuring the writing experience of student participants.

Results

All data were analysed graphically. For the binary response and likert-scale type questions, analysis was done with respect to the response options. For example, we looked at how many students responded yes or no and how many students responded not useful, somewhat useful or extremely useful for these questions. Similarly, the open-ended questions were coded according to each response and all responses were analysed graphically.

How Useful were the Writing Skills Lectures?

On average, the second year students found the writing skills lectures more useful than the third year students. 56% of second years found the lectures to be 'extremely useful', while 42% found the lectures to be 'somewhat useful' and only 2% found the lectures to be 'not useful'. For the third years, 37% of participants found lectures "extremely useful", 61% found lectures "somewhat useful" and 2% rated lectures as "not useful" respectively. This meant that, on average, for the both groups of students combined, 46% found the writing lectures to be 'extremely useful', 52% found lectures to be 'somewhat useful' and 2% felt that they were 'not useful'.
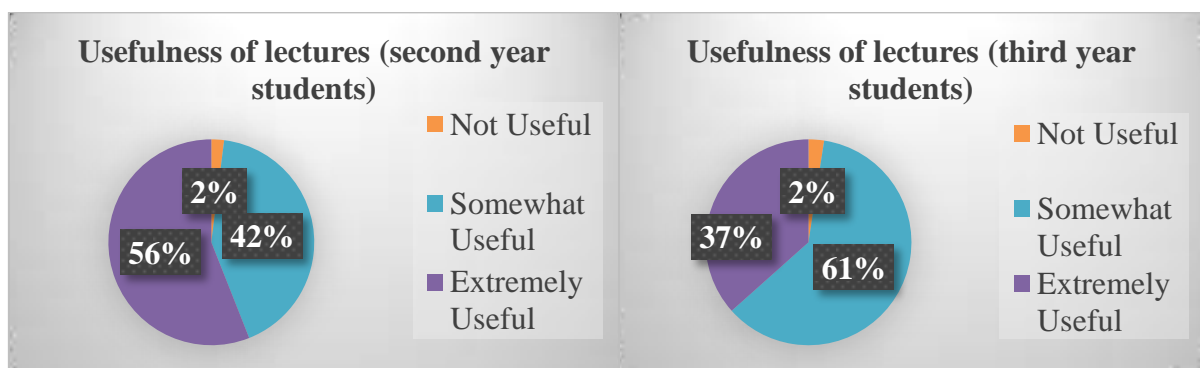
Figure 2: Usefulness of lectures – second year versus third year students

a. Reason for response in question one

For students who felt that the writing skills lectures were 'not useful', the primary concern was that instructions were unclear or difficult to follow. This concern, as well as the opinion that some of the lectures were unnecessary due to their content being self-explanatory, featured prominently amongst respondents who felt that the writing skills lectures were 'somewhat useful'. This group also felt, on average, that the lecturer elaborated well which led to a clearer understanding of concepts while some respondents disagreed and thought that the lecturer's instructions were unclear and difficult to follow. For students who felt that the writing skills lectures were 'extremely useful', the majority felt that the lecturer elaborated well which led to a clearer understanding or that the lectures helped to improve their writing skills.
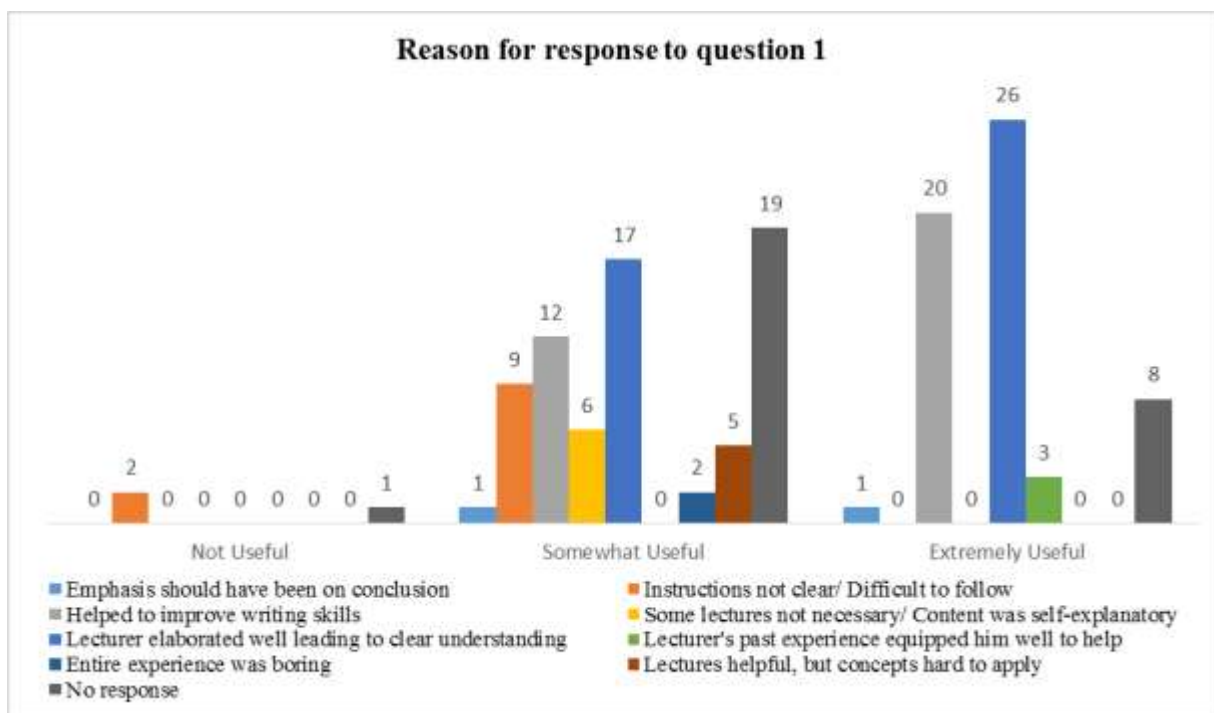
Figure 3: Reasons for response to question 1

b. Process and method applied by students

Table 4: Process and method applied by students

Responses	Second year students	Third year students	All	%
Class Method	35	66	101	75.9
Own Method	3	7	10	7.5

| No Response | 13 | 9 | 22 | 16.5 |

<div align="center">Source: Authors' own adaptation</div>

76% of all students followed the method of writing an academic essay and the structure that was discussed in class.

   c.   What was missing from the writing skills lectures?

When asked what was missing from the writing skills lectures, the most common response was 'tips on how to manage reading large amounts of information', with 21% of the respondents selecting this option. Other most common responses include 'Tips on how to summarise and synthesise large amounts of information' (11%) as well as a combination of both 'Tips on how to manage reading large amounts of information' and 'the research process' (9%).

   d.   What did you like about the writing skills sub-module?

When asked what they enjoyed most about the writing skills system, the two most common responses were that the course helped students to refine their writing skills and prepared them for postgraduate research (38%) and that the course exposed them to new information on an interesting topic (14%). Only 10% of students responded that they didn't enjoy any aspect of the writing system.

   e.   What did you dislike about the writing skills sub-module?

When asked what they disliked most about the writing skills course, the two most common responses were 'nothing' (17%) and that the workload was too much, with too many mini-submissions (11%). Only 2% of all students responded that they disliked everything about the sub-module.

   f.   What more can we do to support you with your writing?

When asked what more could have been done by the lecturer and tutor to support students with their writing, the two most common responses were that there should be more lecture time, more individual consultation time and more writing tutors available to consult with (13%) and 'nothing' (11%). This question also had a high non-response rate of 47%.

g. Did you make use of the writing tutor?

A greater proportion of second year students (61%) chose to consult with the writing tutor than did third years (55%). Overall, 57% of all students sought the help of one of the writing tutors during the semester.

h. If yes, what did the writing tutor help you with? If no, why did you choose not to consult?

Of all students who sought the help of a writing tutor, 87% said that the tutor was helpful in clarifying concepts and explaining instructions and helped with format, structure and referencing for their essays. Of all students who opted not to see a writing tutor, the most common reason cited was that they did not have time to consult with a tutor (12%) or that the lecturer had already explained clearly enough (8%). Some of the results from this question did not make sense entirely. For example, people who answered that they didn't see the tutors still answered option 2.
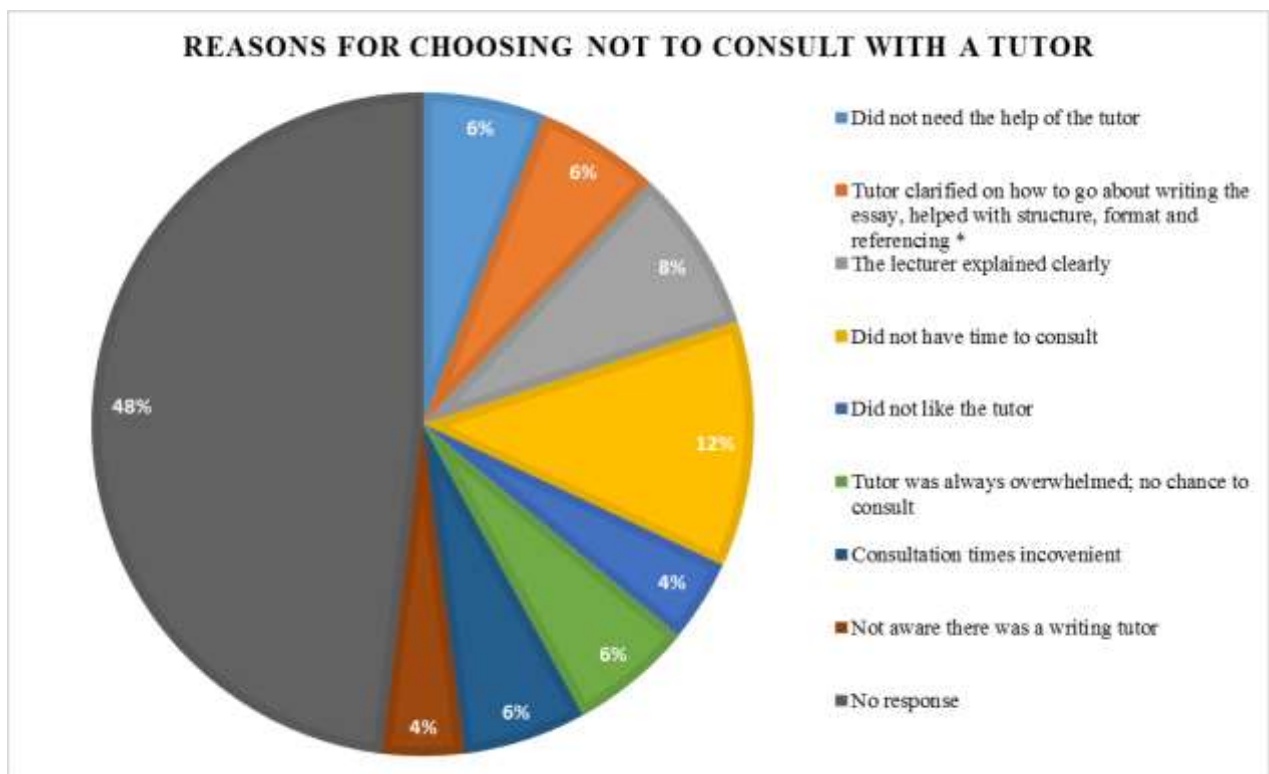
Figure 4: Reasons for choosing not to consult with a tutor

i. Was the writing tutor helpful?

Of all students who opted to seek the help of a writing tutor during the course, 96% responded that they found the writing tutor to be helpful.

  j.   At any point, did you struggle to understand what your lecturer was saying?

23% of all students reported that at one point or another, they struggled to understand what the lecturer was saying.

  k.   Do you struggle to read or write in English?

5% of all students reported that they struggle to read in English and 6% of all students reported that they struggle to write in English.

  l.   Did you attend any BSC Motivational Indabas?

17% of all student participants elected to attend at least one of the motivational indabas.

  m. If not, why did you not attend any of the BSC Motivational Indabas?

Of the students who did not attend any of the motivational indabas, 58% reported that this was because the indabas were scheduled at inconvenient times and 25% reported that they were too busy studying during the time the indabas were scheduled to take place. The remainder of students reported a combination of these two reasons or 'other'.

Conclusion and Recommendations

The study finds that the current writing system does what it was intended to do, and that is to get students to write. Many student participants seem to understand and appreciate the writing system in its current form. They find the lectures useful, complete the weekly activities, engage with the lecturer and writing tutor and write the essay using the suggested writing structure discussed during the lectures.

Despite its success, there are a number of areas that could be improved upon to enhance the student writing experience and participation in the competition. The writing skills system needs to equip students to better read, synthesis and analyse large volumes of information. This could help students to see writing the essay as less intimidating and more manageable. Furthermore, the weekly submissions seem to put students under additional pressure over and above their busy academic timetables. The writing skills system needs to find a way to

enhance student participation through less frequent activities. This could help students to better manage their writing. Longer lecture periods could also assist students to engage with the lecturer regarding the writing process. In addition, past experiences of competition finalists and winners suggest that the motivational talks encouraged them to participate in the competition. This, together with the results from the question 14, is an indication that more needs to be done to encourage students to attend the motivational talks by arranging them at more convenient times during the semester.

Research-guided practice is critical for the development of effective learning and writing opportunities for students in any context. While it is important to implement strategies that may seem effective to improve student engagement and writing, it is important to follow the implementation up with research into the effectiveness of such strategies, especially when student retention and success is a priority. The survey used in this study was by no means comprehensive and does not necessarily imply that the writing system presented here is the only way to encourage undergraduate student writing. A reasonable next step would be to explore other ways to encourage students to write at university. Moreover, it is important to ascertain the value of writing in the overall learning process, by examining whether increased undergraduate writing enhances students' academic engagement and improves overall academic performance.

References

Beaufort, A. (2008). College writing and beyond: A new framework for university writing instruction. Utah: University Press of Colorado.

Brunnermeier, S. (2017) Learning by doing: The challenge of engaging undergraduates in economics research, *The Journal of Economic Education*, 48(4), 290-294.

Elbow, P. (1998). *Writing with power: Techniques for mastering the writing process*. Oxford: Oxford University Press.

Foster, D. (2017). *Writing and learning in cross-national perspective: Transitions from secondary to higher education*. New York: Routledge.

Murray, D. (1972). Teach writing as a process not product. *The Leaflet*, 71(3), 11-14.

Neugeboren, R. H. (2005). *The student's guide to writing economics*. New York: Routledge.

Phakiti, A., & Li, L. (2011). General academic difficulties and reading and writing difficulties among Asian ESL postgraduate students in TESOL at an Australian university. *RELC Journal*, 42(3), 227-264.

Rashied, N. (2017). EBH0004: Macroeconomic Research Skills, week 8 [rubric hand out] - creating single-claim arguments. School of Economics, University of Johannesburg, Johannesburg, South Africa.

Raworth, K. (2017). *Doughnut economics: seven ways to think like a 21st-century economist*. Chelsea: Chelsea Green Publishing.

Sullivan, G. M. (2011). A primer on the validity of assessment instruments, *Journal of Medical Education*, 3(2), 119 – 120.

Toulmin, S. (1958). *The Uses of Argument*. Cambridge: Cambridge University Press.

University of South Africa. (2018). Department of Economics. Retrieved June, 25, 2018, from http://www.unisa.ac.za/sites/corporate/default/Colleges/Economic-and-Management-Sciences/Schools,-departments,-bureau,-centres-&-institutes/School-of-Economic-and-Financial-Sciences/Department-of-Economics.

Wentzel, A. (2011). EBH0004: Macroeconomic Research Skills, week 7 [lecture hand-out] - creating single-claim arguments. Department of Economics and Econometrics, University of Johannesburg, Johannesburg, South Africa.

ADULT EDUCATION AS A CONDUIT FOR IMPROVING PARTICIPATION OF YOUNG WOMEN IN THE STEM FIELDS

Lineo Toolo & Mpho Dichaba
University of South Africa

Abstract

This paper sought to determine the reasons why young women do not choose careers in the STEM as much as they do in the social fields and how adult education can be used to enable them to choose careers in the STEM fields for their holistic youth development. Traditionalism and culturalism theories were used to investigate whether women avoid the STEM fields based on the fact that such fields are said to be 'demanding' while at the same time they still have binding responsibilities in line with culture and tradition after performing their professional responsibilities or whether the STEM subjects are too difficult for women and can only be mastered by men as it is believed in some communities. A qualitative research design was used to conduct an empirical investigation through semi-structured interviews with lecturers, young men and women in the STEM field in two selected universities in South Africa. This paper recommends that women and men need to compete equally, at all levels and in all career fields, in order to benefit equitably from the resources at their exposal for economic opportunities and social transformation.

Keywords: Adult education, socio-economic transformation, South Africa, STEM, young women.

INTRODUCTION

According to Department of Women (2015), before the dawn of the democratic government in South Africa, most women were subjected to 'triple oppression' in the form of gender, race and class inequalities, e.g. blackest women were in low-skill jobs as domestic workers. On the other hand, the labour market had been dominated by men. Those who were traditionalists and believed in a patriarchal society were encouraging that situation; hence in some communities it was not important for girls to attend school. This situation was made worse by the apartheid system which excluded blacks in general from educational opportunities, including freedom to choose certain subjects, in an effort to use them as a pool of unskilled labour (ibid).

To correct this situation, the democratic South Africa ratified a number of legal instruments that were advocating the promotion and protection of women's rights, to ensure that women, including young women, are developed and empowered politically, socially and economically. Instruments such as the National Education Policy Act (NEPA), Act 27 of 1996, the South African Schools Act (SASA), Act 84 of 1996 etc., were meant to assist the country to transform the education system and enable access to education by all. The Constitution of the Republic of South Africa, Act 108 of 1996 itself was developed to ensure that all citizens receive among others, education of their choice, irrespective of their gender, race and class (Department of Women, 2015). Based on this, our conclusion is that South Africa needs a youth community in general, that will take advantage of the above and more opportunities, enabling them to freely study careers of their choice, to theirs and the country's socioeconomic benefit.

Young women in particular, need to choose careers that were not accessible to them in the past, as per the above report. Department of Women (2015), highlights the demand for STEM graduates in workplaces in South Africa since a science-based innovation is regarded as a big economic driver in the country. Unfortunately, many women are not choosing these fields. In 2012 women constituted 79.3%, 73.8% and 73.7% in the education, health and welfare fields, which are referred to as gender-defined fields. As per this report, even in the health sector, women graduate in large numbers as nurses and health care workers, not in the higher degree specialisation areas. The low percentages of women STEM graduates (28,5%) in engineering, manufacturing and construction has prompted the government to set guidelines to improve the distribution of bursaries and scholarships, targeting a proportion of 55% support for women pursuing postgraduate studies. These bursaries have increased the enrolment of STEM postgraduates from 50% enrolment in 2011/2012 to 53% in 2012 (ibid). These were good results, considering the period of time between the implementation of these bursaries and the outcome thereof, i.e. 3% increase in about 12 months.

One other strategy that has achieved good results in trying to improve the low numbers of girls in the STEM fields in South African high schools is the Techno-Girl Programme which was established in 2005. The Techno-Girl Programme identifies girls who are studying the STEM subjects from previously disadvantaged communities, through the Department of Basic Education and places them in structured job shadowing Programmes at various organisations during school holidays. The ultimate goal of Techno-Girl is to expose girls to

the world of work, in the STEM fields in order to enable them to make informed career choices beyond schooling. The other embedded aim is for the workplaces where the girls are placed to provide them with bursaries for their tertiary studies if possible and/or ultimately take them up as future employees (Techno-Girl, 2015).

As a result of this programme, of the 1391 girls who completed the job shadowing phase of Techno-Girl for the Grade 12 National Senior Certificate examinations in 2015, only 1280 (92%) were contactable. It was then found that for Grade 12 results, 824 (64%) achieved a Bachelor pass, 272 (21%) a Diploma pass and 66 (0,05%) a Higher Certificate pass (Techno-girl, 2015). For a developing country, the above scenarios are a proof that South Africa can do it.

THEORETICAL FRAMEWORKS: TRADITIONALISM AND CULTURALISM

According to Tjomsland (2009), in the more patriarchal societies, men are regarded as natural managers of subjects such as technology, science and business. This creates the impression that whatever work women do, they are not expected to be on the same level with men or else they turn to be overburdened since they are expected to still perform duties defined by culture and tradition. In support, Latchanah and Singh (2016) reported that there is a continuing intersection of gender and race that normally brings about conflict between balancing work and family responsibilities. Consequently, in most cases research participants hide their cultural identity and adopt the organisational one, to comply with the research conducted. In the reported case, research participants noted that balancing professional and their personal cultures, which was African, could not be achieved because the two have different and conflicting demands. According to the report, women are still regarded as the bearers of primary family responsibilities like domestic chores but management does not accommodate or prioritise such duties over work.

What was concluded from the above information, was that women might be shying from taking up the STEM fields as careers, in order to comply with stereotypical cultural and traditional expectations. Therefore, a need presented itself, of intentionally encouraging and enabling young women to improve their participation in the STEM sector, through adult education.

RESEARCH QUESTIONS

This study sought to examine how adult education can be used as a conduit for improving participation of young women in the STEM fields by posing the following research questions:

RQ 1: What are young women's reasons for choosing careers in the STEM as compared to the social fields in South African universities?'

RQ 2: How enabling are the current adult education programmes for young women to choose careers in the STEM fields, for their sustainable/holistic youth development?

RQ 3: What strategies can be implemented to improve the participation of young women in the STEM fields?

RESEARCH METHODOLOGY

To answer the research questions posed above, a qualitative research approach was adopted. Davies (2007) says that qualitative research involves an interpretive and naturalistic approach to the world. This means that qualitative researchers study things in their natural setting, attempting to make sense of or to interpret phenomena in terms of the meaning people bring to them.

Two South African universities were selected for this study to investigate what influences the choice of careers of young women in South African universities, resulting in their low numbers in the STEM fields. These two universities are found in different provinces, adjacent to each other but holding completely diverse historical backgrounds. One is a historically open distance learning institution, with its main campus in Pretoria, in Gauteng Province. It services not only South Africans but Africans and students in other parts of the world. Another university's main campus is in Bloemfontein, in the Free State Province. The latter university previously served white South Africans only, with Afrikaans as the main medium of instruction. This university is currently undergoing transformation in terms of the language of instruction and a number of progressive issues.

For qualitative research, the interview results of purposively selected two young women and two young males from two universities in South Africa helped us to understand what influenced most of them, as this was revealed by the pattern of their responses to the same

questions, e.g. Why did you choose the STEM fields as your career and not any other field? This study focused on young students who are between 18 and 35 years of age, registered in the STEM fields in South African universities as well as their lecturers. Two purposively selected STEM lecturers (one from each university) were also interviewed. The interpretive paradigm became the most suitable choice for the qualitative method since it was necessary for us to interpret data collected and presented in the social context of the participants, e.g. to understand whether the choice of careers of young women in South African universities is influenced by their nature, based on general social expectation, cultural beliefs, economic values or any other aspect, that would have been presented during data collection processes.

Prior to collecting data, ethical clearance was sought from the two universities and permission was granted by the University Research Ethics Committee. The respondents were informed that their participation is voluntary and that they could decline to answer any of the interview questions if and when they so wished. For data analysis, we used a coding system. Creswell *(*2014) define it as the marking of segments of data with symbols, descriptive words or unique identifying names. The process of coding enables researchers to retrieve and rapidly collect together all the text and other data that is associated with some thematic ideas, in order that the sorted bits can be examined together and different cases may be compared. In this paper, data collected was also sorted according to three themes developed for interviews: (i) career choice and (ii) adult developmental programmes.

FINDINGS AND DISCUSSIONS

Career choice

The aim of this section was to determine the reasons young women do not choose careers in the STEM like in the social fields'. Participants had to answer the question, 'What are young women's reasons for choosing careers in the STEM as compared to the social fields in South African universities?' However, since the sample comprised young women who had already chosen the STEM fields as careers, the question had to be phrased positively, otherwise it would have been irrelevant to the respondents. The reasons provided were used to deduct and understand why those who choose the social fields in large numbers do not choose the STEM fields. What we had expected was that the reasons provided by young women would be different from those provided by young men, since most young women are seemingly not

attracted by the same things that attract young men (e.g. high salaries), irrespective of whether they have good returns or not (Department of Women, 2015).

A number of responses depicted the STEM as special subjects, e.g. one (female) student responded that she *chose the STEM fields because she was 'a hard worker'*. This answer implies that individuals can only choose a STEM field if they are hard workers. Another response was that *I liked working with my hands in the laboratory, solving problems.* Other participants' responses showed great passion for the STEM fields, e.g. a female student whose response was, *'My fields of mathematics and physics made me choose the STEM fields…because I didn't have another choice, I love it'*. Another female student also responded likewise: *'I felt it was easy to study as I love it'* and a male student indicated that *'I chose the field because I know that I am good at it'*.

A male student, who seemed to appreciate his father's influence, responded as follows to the above question: *'I grew up with a father who works in the field, so I grew up learning and getting passionate about these fields'*. The other student (also male) said he chose the STEM fields because, *'I am influenced by people around me and (I also chose them) to lift up my life'*. On the other hand, the response from a female student was very direct, creating a suspicion that the respondent was bitter. She said: *'I did not choose the STEM fields. I was bullied by my parents to study them'*. These two opposite responses made us think that parents do have influence on the choice of careers towards or away from certain fields. In the case of this young man who developed the love for the STEM fields because of his father, the influence was positive but a negative influence is reflected in the response from the young woman who was bullied into the fields by her own parents. This brought an understanding that an element of cultural stereotyping is still practised by some parents, where they feel obliged to choose careers for their children without necessarily guiding them by showing them the benefits of studying the STEM fields but bully them into such or any other fields for that matter.

This bullying of children and learners in or out of the STEM fields has bitter repercussions as it may even lead to them leaving the STEM fields once they are independent and acting on their own authority. This opinion was later confirmed during an interview with a female student who claimed that *'teachers 'automatically' allow entry to a subject to boys when they*

choose the STEM subjects at high school, even if they do not have the potential but girls must get their approval to do so.

The above question also appealed to the respondents to think about the future since studying for a particular career means one is preparing for the future as well as making a difference to others. An emphasis of the need to invest for the future in the STEM fields because of global warming and security of food supply (Accenture Consulting Technology Outsourcing, 2014), was revealed in these participants' responses: '*I want to contribute to the future of our country*' (male student) whilst another said: '*So that I am well updated…the field is interesting because you get to learn about life in general*'. The response from a student (male) who is studying to be a STEM teacher was that '*I would like to empower those who are good at science and technology or those who are interested in the STEM fields as it is*'. He also emphasised that he is doing this because he likes mathematics. This was supported by another male respondent who indicated that, '*I love maths and science and I'd like to put that same love in other people in order for them to have more career choices when they leave school*' and another female student maintain that '*because I know that in South Africa people who are doing maths are few*'. In addition to this, one of the respondents put it simply that he wants to empower the learners, whilst a male respondent said, '*I want to better the lives of the youth*'. A female student said: '*It's important and I want to make a change*' and another female reported that she chose the STEM fields because she wanted to give back to the community.

The opinion of developing young people in the STEM fields in order to keep a balance of skills between these fields and the social fields for their socioeconomic empowerment, has been outlined in the responses provided by the students hereunder. The benefit of that as mentioned by the Department of Women (2015), is that neither of the two mentioned fields would be overcrowded nor underused if young women pursue both fields equitably, i.e. registering in large numbers in the STEM fields because their numbers are already extensive in the social fields (Department of Women, 2015). Some responses from the female respondents were that, when following STEM fields, one contributes to the development of young people in South Africa. A female student's response was that, she chose the STEM fields *'for stability and to gain a different talent and skill'*. In what sounded like a plan for a better future as mentioned above, one female student stated that she chose the STEM *'for better opportunities'*.

The previous paragraph reveals the urge for self-development by young people, which is said to be bringing 'stability' to the future of individuals. This desire continues to be affirmed, as one male respondent said, '*I chose those fields specifically as I know they will develop me in a sense that I will be a critical thinker in terms of finding solutions that are currently affecting our country*'. At the same time, there was one who indicated that he *likes thinking out of the box and careers in the STEM fields require one to be as creative as possibl*e. Thinking out of the box and being creative form an important part of young people's development.

As previously mentioned, young men are already aware of the importance of technology these days, hence they are already taking up careers in the STEM fields in big numbers (Tjomsland, 2009). One of them said he chose the STEM fields because,

> '*Today the world is about STEM, so it is going to make my life easier to live and giving me the opportunity to pass on the information that I've learnt to the next generation*'.

Another respondent highlighted that,

> '*I love information technology, so everything that has technology fascinates me because I want to be able to move with the time always, also to be able to solve problems using current ways of technology*'.

This found reverberation with one who said he chose the STEM fields because he has *passion for science and technology and it allows him to be adventurous.* One female student confirmed the stereotypes that there is belief that these fields are difficult by saying:

> '*Back at home many people think that these fields are difficult but for me it has been just challenging and I personally like being challenged*'.

In addition to this, there was one who explained that there are more job opportunities out there and that the STEM fields were his favourite area. One female student said that '*the STEM subjects help her to reason out some of the things created and figure a way to resolve them by thinking*'.

One of the lecturers (male) who was responding to the same question on what the reasons for young people are, to choose careers in the STEM fields nowadays at universities, responded that:

> "*the STEM fields are challenging and are an important career choice that is necessary for the development of the country and without STEM graduates, the country cannot develop in STEM areas, power, food, agriculture etc*".

A female lecturer responded by stating that

> "*there are traditional stereotypes stating that these fields are difficult and not made for women but that is not true*".

Adult Education programmes

The purpose of this question was to ascertain the following: '*How enabling are the current adult education programmes for young women to choose careers in the STEM fields, for their sustainable/holistic youth development?* The responses to this question were both affirmative and negative as some respondents gave a resounding, 'yes', and others a 'no'. Our interpretation for those who responded out-rightly negative to the availability of programmes, irrespective of whether such programmes are effective or not, was that such programmes are not well advocated. To those who agreed, our understanding was that *such programmes are available for young people in general but were not sufficiently women-specific to address the issue in question, since women are still registered in small numbers in the STEM fields.* One of the male students responded with a definite 'No' in his answer and continued to say: '*The government is failing us*'. This means he is aware of the relationship between government and universities, regarding policies and programmes and that government needs to provide guidance, as universities contextualise such and implement (World Bank, 2009).

During one interview, a young woman became emotional when responding to the question why she chose a career in the STEM fields. She explaining that she wanted to be a doctor but did not have sufficient funding. As a result, she became a STEM teacher, which was a consolation for her. Our interpretation to this was that the STEM fields are more expensive than some of the social sciences; hence many young women flock to these fields.

Student respondents did not know that *'universities have programmes that enable the participation of young people in the STEM fields.* The lecturers were the ones who knew and mentioned different *initiatives like the Science and ESKOM Expo Programmes, the FUNZA; Kutlwanong School of Mathematics and Science and the 'First Generation of Students' as well as the 'Grow your Timber' programmes residing in the Department of Higher Education and Training.*

One lecturer said that *'there are discussions in that regard between the two sectors, i.e. government and universities and that information is being compiled, indicating that women are not working in large numbers in the STEM fields'.* The student participant agreed that *'there is a lot of information provided during orientation but since there is already a concept that the STEM fields are difficult, especially at university level, most students (young women) avoid them'.*

In getting a sense of how interviewees would go about designing an adult education programme to improve participation of young women in the STEM fields at universities, should they be requested to do so, one lecturer emphasized the need for learners and students to be consulted, to identify their needs and then build a programme based on that, in high schools as well. *'They will then own it and implement it smoothly and then there will be a need for a monitoring tool to be developed, piloting the programme in certain institutions first and then getting information from the pilot project to improve it if necessary. Amendments would be effected and young women who are interested in the STEM fields be encouraged to participate. A database could be established of young women who are interested in the sciences. Even those who are unemployed would be supported with bursaries. In their final year, students would be given information on programmes beyond the undergraduate levels'.*

CONCLUSION

In order to attract girls as students and women as professionals to the STEM fields, education, training and skills development should be aligned to the needs of the market. In view of the current economic threats mentioned here, girls and boys, women and men should be enabled to freely access fields of their choice and for their equal benefit. If the STEM fields remain inaccessible to girls and young women as described, the country will continue

to produce graduates that return home at the end of their studies, thereby adding to the problem of unemployment which is already excessive in South Africa. Young women should be encouraged to rise to the occasion because their numbers in STEM field careers are the lowest. The choice of careers by young women should be in line with the current needs of the country. We are also recommending training for the parents of girls and young women who are interested in the STEM fields or the prospects thereof.

Young women, however, should be stimulated, motivated and deliberately encouraged in the form of policy and programming to study and pursue a professional career in the STEM fields.

The following are suggestions from different respondents:

- Raising funds for technology and assuring women that they will find jobs in the STEM fields.
- A solid maths and science at primary and secondary levels will pave the way to STEM fields at higher levels'.

Our perspective is that, if the STEM fields are regarded as the main contributor to the alleviation of food shortage and other related results of global warming, then these fields should be prioritized. Since this study has also proven that there is a shortage of young women's talent in such fields in South African universities, adult education programmes that are meant to close that gap should be developed and implemented as a matter of urgency.

References

Accenture Consulting Technology Outsourcing. (2014). *Powering economic growth: Attracting more young women into science and technology*. Silicon Republic.

Constitution of the Republic of South Africa, Act 108 of 1996. 1996. Pretoria: Government Printer.

Creswell, J.W. (2014). *Research design: Qualitative, quantitative and mixed-methods approaches.* Thousand Oaks, CA: Sage.

Davies, M.B. (2007). *Doing a successful research project: using qualitative or quantitative methods*. New York: Palgrave Macmillan.

Department of Women. (2015). *The status of women in the South African economy.* Pretoria: Government Printer.

Department of Higher Education and Training. (2015). *Staffing South Africa's universities framework: A comprehensive, transformative approach to developing future generations of academics and building staff capacity*. Pretoria: Government Printer.

Latchanah, C. & Singh, S. 2016. An investigation of the challenges faced by women when progressing into leadership positions: A case of the IT division at Barclays Africa Technology (Trading as ABSA). *Journal of Management and Administration. (1), 36–71.*

National Planning Committee. (2011). *National Development Plan: A vision for 2030*. Brand South Africa.

National Education Policy Act (NEPA), Act 27 of 1996. (1996). Pretoria: Government Printer.

Shin, Y. & Lee, J. (2017). Predictors of career decision self-efficacy: Sex, socioeconomic status (SES), classism, modern sexism and locus of control. *Journal of Career Assessment*, 1–16. doi:10.1177/1069072716658649.

South African Schools Act (SASA), Act 84. (1996). Pretoria: Government Printer.

Techno-Girl (2015). Alumni Milestone Report. Johannesburg: UWESO Consulting.

Tjomsland, M. (2009). Women in higher education: A concern for development. *Gender, Technology and Development;* 13 (3):407–27. Los Angeles: Sage.

World Bank. (2009). *Literature review on equity and access to tertiary education in the Africa region*. Washington, DC: World Bank.

TEACHERS' KNOWLEDGE AND USE OF HANDS-ON ACTIVITIES IN TEACHING CHILDREN WITH INTELLECTUAL DISABILITIES IN ILORIN METROPOLIS, NIGERIA

Olubukola Christianah Dada & Adegoke Oladipo Olaniyan
Kwara State University, Malete, Nigeria.

olubukola.dada@kwasu.edu.ng; adegoke.olaniyan@kwasu.edu.ng

Abstract

Intellectual Disabilities are genetically based disabilities that affect the intellectual functioning and adaptive behaviour of affected individuals during the developmental period. Children with intellectual disabilities are on the increase in Nigerian classrooms and this children must also be catered for during teaching and learning process. The federal government of Nigeria through the national policy on education has recommended inclusive education for children with special needs which include children with intellectual disabilities in order to help them attain optimal development. However, teachers need to be abreast of instructional strategies for teaching children with intellectual disabilities. Therefore this study examined teachers' knowledge and use of hands-on activities in handling children with intellectual disabilities in Ilorin metropolis. The study adopted descriptive survey research design. The population comprised of all primary school teachers in Ilorin metropolis. Simple random sampling technique was used to select 20 primary schools in each of the three Local Government Areas of Ilorin metropolis. Disproportionate stratified sampling was used to select 12 private primary schools and 8 public primary schools in each Local Government Areas. Two research questions were raised and answered in this study, data were collected through Teachers' Knowledge of Hands-on Activities in handling Children with Intellectual Disabilities (TKHACID = 0.78) and Rating Scale on Teachers' Use of Hands-on Activities in handling children with Intellectual Disabilities (RSTUHACID = 0.82). Findings showed that teachers' knowledge of hands-on activities in handling children with intellectual disability is poor and their use of hands-on activity is low. Based on the findings, it was recommended that teachers should be trained and retrained on hand-on activities.

Keywords: Intellectual disabilities, teachers' knowledge of hands-on activities, teachers' Use of hands-on activities

Introduction

Early years are the most important to the formation of intelligence, personality and social behaviour of a child because the years before a child reaches kindergarten (0-5) are among the most critical in his or her life to influence learning. That is why modern societies show serious concern for the education of their young ones by providing the needed support to prepare them to succeed later in school (Charles, Madu and Adigun, 2016). Education and

training required for the development of children must start early in their life, that is, from childhood. This is because the childhood period is the time when children develop basic values, attitudes, skills, behaviours and `habits which will be long lasting (UNESCO, 2008).

The quality of the teachers determines the strength of any educational system and the value of the learners (Adigun, Onihunwa, Orunokhai & Sada, 2015). Thus, the success of any system of education depends to a large extent on the number of teachers and their quality, their devotion to duty and their effectiveness on the job (Ede, 2003). The need for high quality childhood teacher options is growing rapidly in response to changes in work and family patterns (Adigun, Onihunwa, Orunokhai & Sada, 2015). Advocates of developmentally appropriate childhood education are increasingly interested in promoting inclusive programme of early education of both developing children and children with disabilities (Akinbote & Olaniyan, 2016). The success of such programmes is contingent upon the availability of personnel trained to meet the individual needs of children with a wide range of abilities (Kemple, Hartle, Cornea & Fox, 2007).

Tasse (2016) defined intellectual disability as a handicap characterized by significant disabilities in both intellectual functioning and adaptive behaviour, as it is expressed in the required conceptual, social and practical adaptation skills. Intellectual disability is an extremely stigmatising condition that affect the intellectual functioning and adaptive behaviour of the affected individuals during the developmental period. Harris (2006) reported the prevalence of intellectual disability to vary between 1% and 3%, globally. Among those with intellectual disability, mild, moderate, severe, and profound mental retardation affects about 85%, 10%, 4%, and 2% of the population, respectively (King, Toth, Hodapp, & Dykens, 2009). There are few incidence studies. Heikura et al. (2003) reported incidence of 9.1 and 12.6 per 1000 population, in their study from the U.S. and Finland, respectively. While the initial study reported a cumulative incidence of a 5-year birth cohort, the latter was based on two birth cohorts.

Scholars argue that there is no particular known cause of delay development in people with intellectual disabilities (Gibbons, Cihak, Mynatt & Wilhoit, 2015). It is widely agreed that all people with intellectual disabilities have deficits in intellectual functioning and face challenges in adaptive behaviour. People with intellectual disabilities often show

discrepancies in self-determination skills and problems in skill areas like decision-making, setting goals and solving problems (Haegele & Park, 2016).

Teachers must be vast in instructional strategies that can be employed to assist these categories of children with intellectual disability. Instructional strategies are collection or organizational tools to manage pupils' learning (Gardner & Hatch, 2004). No one can deny that schools are becoming diverse in terms of children's background and abilities and teachers are being more challenged to find effective ways to meet diverse needs of their children, one of which is hands-on activities. For teaching to be effective, the teacher must not only have the knowledge of the goal and what to teach (subject matter) but how to teach effectively (pedagogical skills).

Hands-on activities is a practical work or experience which is one situational factor that is often assumed to evoke learners' interest and to motivate them to learn science (Bergin 1999). Hands-on in general means learning by experience. Learners handle scientific instruments and manipulate the objects they are studying (Rutherford 1993). It is assumed that working in a hands-on way provides a more realistic and exciting experience of the content (Franklin and Peat 2005). Most empirical studies provide evidence for the assumption that conducting hands-on activities leads to positive motivational outcomes.

Several studies in the literature show that hands-on activities help learners to outperform learners who follow traditional, text-based programs (Turpin, 2000), to enhance their understanding and replace their misconceptions with the scientific ones (Coştu, Ünal & Ayas 2007; Ünal, 2008), to develop attitudes toward science positively (Bilgin, 2006; Bristow, 2000), and to encourage their creativity in problem solving, promote learners' independence, improves skills such as specifically reading, arithmetic computation, and communication (Haury & Rillero, 1994). Children learn better when they can touch, feel, measure, manipulate, draw, make charts, record data and when they find answers for themselves rather than being given the answer in a textbook or lecture.

Hands-on activities let the learners' minds grow and learn based on the experiences and the environment they are exposed to. As the students become familiar with the subject they are learning, they begin to make decisions, requiring less teacher support and allowing more interactive learning experiences to occur (Cooperstein & Kocevar-Weidinger, 2004). Hands-

on educational activities are dynamic, relevant, and applied. Others have used language to express similar ideas, such as experiential, student-centered, playful, or active learning. Hands-on learning is nothing new. In fact, as early as 350 BCE Aristotle wrote, "For the things we have to learn before we can do them, we learn by doing them." What has changed is *how* we incorporate hands-on actvities into training.

Children with intellectual disabilities benefit from the same teaching strategies used to teach people with other learning challenges. When teaching children with intellectual disabilities it is essential is to break down learning tasks into small steps. Each learning task is introduced, one step at a time. This is important to avoid overwhelming the children with intellectual disabilities. Once the child has mastered one step, the next step is introduced. With this the teaching learning process becomes more progressive, step-wise, learning approach. Lengthy verbal directions and abstract lessons are ineffective teaching methods for most children with intellectual disabilities. This means they learn best by performing a task "hands-on." This is in contrast to thinking about performing it in the abstract. A hands-on approach is particularly helpful for children with intellectual disabilities. They learn best when information is concrete and observed. Students with intellectual disabilities do best in learning environments where visual aids are used. This might include charts, pictures, and graphs. These visual tools are also useful for helping students to understand what behaviours are expected of them. For instance, using charts to map children's progress is very effective. Charts can also be used as a means of providing positive reinforcement for appropriate, on-task behaviour (Dada, 2015). The use of visual, auditory and kinaesthetic activities are important for children with intellectual disabilities due to their low intelligent quotient which inadvertently affect their memory leading to lack of retention of learning. The use of hand on activities enable them to recall learnt materials easily. Research shows that learning happens best when it is done in a way that is practical, relevant, and engaging—rather than theoretical and decontextualized— and that learning happens everywhere, anytime (Winthrop, Williams & McGivney, 2016). Children with intellectual disabilities depending on the severity of the condition learn best when they are engaged. Hands-on projects obviously engage kids who are tactile or kinesthetic learners, who need movement to learn best. They also engage students who are auditory learners, who talk about what they're doing, and visual learners, who have the opportunity to see what everyone else is creating. For social learners, the time spent in small group conversation will strengthen their knowledge

Studies show that children learn best when learning is active, when they are engaged in hands-on activities, and involved in what they are learning (Salami, 2009). Scientists believe that when children use all of their senses it helps the brain create pathways that make it easier and quicker to retain information. In fact, students of all ages can benefit from adding hands-on activities to their learning. Whether they are learning about mathematics or science, history or language, hands-on activities can be added and adapted to any curriculum (Wagner, Newman, Cameto, Garza, & Levine, 2005). According to Newman, Wagner, Cameto, Knokey and Shaver (2010), the lowest percentage of students from any disability category attending postsecondary education has been that of learners with intellectual disability. Therefore, this study examined teachers' knowledge and use of hands-on activities in handling children with intellectual disability in Ilorin metropolis.

Theoretical Framework

Activity theory was propounded by Vygotsky, Leont'ev, Luria, and some German philosophers (from Kant to Hegel) in the early 20th century (Engestrom, 1999). Activity theory was updated recently by Yrjo Engestrom and it states that the unit of analysis (of learning) is motivated activity directed at an object (goal) which includes cultural and technical mediation of human activity, and artefacts in use (and not in isolation). It is more of a descriptive meta-theory or framework than a predictive theory. It considers entire work/activity system (including teams, organizations, etc.) beyond just one actor or user. It also accounts for environment, history of the person, culture, role of the artefact, motivations, complexity of real life action and so on.
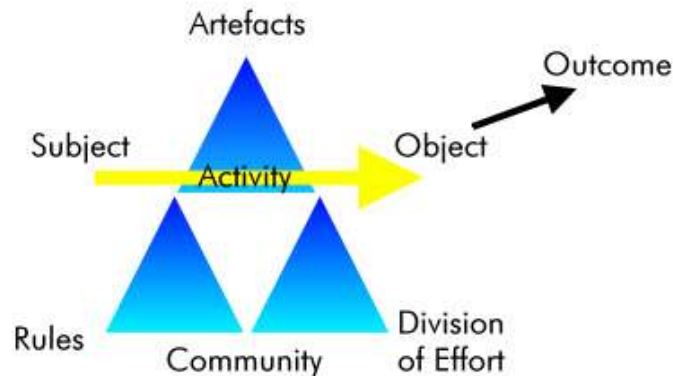
Figure 1. Activity System Chart (1999). **Source**: Learning theories.com: Knowledge base and webliography

Engestrom's model as shown above is useful for understanding how a wide range of factors work together to impact an activity. In order to reach an *outcome* it is necessary to produce certain *objects* (things to use e.g. experiences, knowledge, and physical products). Human activity is mediated by artifacts (e.g. tools used, documents, recipes, manipulative and so on). Activity is also mediated by an organization or community. In addition, the community may impose rules that affect activity. The subject works as part of the community to achieve the objectives. An activity normally also features a division of labour.

Three levels of activity suggested by this theory include:

i.   Activity towards an objective (goal) carried out by a community. A result of a motive (need) that may not be conscious social and personal meaning of activity (Answers the Why? question)

ii.   Action towards a specific goal (conscious), carried out by an individual or a group possible goals and subgoals, critical goals (Answers the What? question)

iii.   Operation structure of activity typically automated and not conscious concrete way of executing an action in accordance with the specific conditions surrounding the goal (Answers the How? question)

Based on this theory, this study considers activity-based strategy as a process of blending together of materials, the learners, the classroom situation, rules and regulations guiding the

activities and the networking among the learners and the teacher in order to achieve the pre-determined behavioural objectives.

Research Questions

1: Do teachers have adequate knowledge of hands-on activities in handling children with intellectual disabilities in Ilorin metropolis?

2: To what extent do teachers use hands-on activities in handling children with intellectual disabilities in Ilorin metropolis?

Methodology

The study adopted descriptive survey research design. The population comprised of all primary school teachers in Ilorin metropolis. Simple random sampling technique was used to select 20 primary schools in each of the three Local Government Areas of Ilorin metropolis. Disproportionate stratified sampling was used to select 12 private primary schools and 8 public primary schools in each Local Government Areas because there are more private schools than public schools in Ilorin metropolis. Simple random sampling technique was also used to select two (2) teachers in each selected schools. A total of sixty (60) schools and one hundred and twenty (120) teachers participated in this study. Two research questions were raised and answered in this study, data were collected through Teachers' Knowledge of Hands-on Activities in handling Children with Intellectual Disabilities (TKHACID = 0.78) and Rating Scale on Teachers' Use of Hands-on Activities in handling children with Intellectual Disabilities (RSTUHACID = 0.82).

Results

Research Question 1: Do teachers have adequate knowledge of hands-on activities in handling children with intellectual disabilities in Ilorin metropolis?

Table 1 showing Teachers' Knowledge of Hands-on Activities in Handling Children with Intellectual Disabilities

Actual Score	Aggregate	Frequency	%	Mean Score	Std.D	Remark
0-7	0-39%	18	15			Poor
8-11	40-59%	52	43.2	07.047		Fair
12-13	60-69%	25	21	(35.3%)	3.683	Good
14-20	70% and above	18	15			Excellent
No attempt		7	5.8			

Total	100	120	100			

Table 1 shows that teachers' knowledge of hands-on activities in handling children with intellectual disabilities in Ilorin metropolis is poor (mean = 07.05). The detailed analysis is as follows: teachers who scores are between 0-7 were rated poor with a frequency of 18 which accounted for 15% of the sampled population, teachers with scores ranging from 8-11 were rated fair with a frequency of 52 which accounted for 43.2% of the sampled population, teachers with scores ranging from 12-13 were rated good with a frequency of 25 which accounted for 21% of the sampled population, and teachers with scores ranging from 14-20 were rated excellent with a frequency of 18 which accounted for 15% of the sampled population.

Research Question 2: To what extent do teachers use hands-on activities in handling children with intellectual disabilities in Ilorin metropolis?

Table 2 showing Teachers Extent of Use of Hands-on Activities in Handling Children with Intellectual Disabilities

S/N	ITEMS	A	S	N	MEAN	STD.D
1	Teacher allows the children to work in groups	20 (16.7)	35 (29.3)	65 (54)	1.345	0.560
2	Teacher allow the children to learn on their own and by their own pace	14 (11.7)	39 (33)	67 (55.3)	1.276	0.544
3	The teaching and learning process in the classroom is interactive	27 (23)	45 (38)	48 (39)	1.567	0.457
4	The children are engaged in different activities that are incorporated by the teacher	18 (15)	28 (23.3)	74 (61.7)	1.023	0.573
5	The children are not passive but active in the classroom	31 (25.8)	42 (35)	47 (39.2)	1.634	0.370
6	The children are allowed to try things out, touch, feel and manipulate objects	12 (10)	31 (25.8)	77 (64.2)	1.043	0.562
7	There are enough learning and stimulating materials around for children to manipulate	15 (12.5)	44 (36.7)	61 (50.8)	1.324	0.630
8	Teacher allow children to move around in the classroom	13 (10.7)	28 (23.3)	79 (66)	1.034	0.702
9	The teacher does less talking and chalking rather facilitating and guiding in the classroom	20 (16.7)	38 (31.7)	62 (51.6)	1.243	0.514
10	The teacher moves around to observe what the children are doing	24 (20)	42 (35)	54 (45)	1.322	0.622
Weighted Average = 1.28						

A= (ALWAYS), S= (SOMETIMES), N = (NEVER)

Table 2 shows that the extent of teachers' use of hands-on activities in handling children with intellectual disabilities is low (WA = 1.34). The detailed analysis is as follows: The children are not passive but active in the classroom (mean = 1.63), The teaching and learning process in the classroom is interactive (mean = 1.57) were rated sometimes while teacher allows the children to work in groups (mean = 1.35), The teacher moves around to observe what the children are doing (mean = 1.32), There are enough learning and stimulating materials around for children to manipulate (mean = 1.32), Teacher allow the children to learn on their own and by their own pace (mean = 1.28), The teacher does less talking and chalking rather facilitating and guiding in the classroom (mean = 1.24), The children are allowed to try things out, touch, feel and manipulate objects (mean = 1.04), Teacher allow children to move around in the classroom (mean = 1.03) were rated never.

Discussion

The finding showed that teachers' knowledge of hands-on activities in handling children with intellectual disabilities is low. This may be as a result of the quality of teachers teaching at this level of education, where majority of them are not qualified and untrained. This finding negate the finding of Gardner and Hatch (2004), that teachers must be vast in instructional strategies that can be employed to assist these categories of children with intellectual disability. No one can deny that schools are becoming diverse in terms of children's background and abilities and teachers are being more challenged to find effective ways to meet diverse needs of their children, one of which is hands-on activities. For teaching to be effective, the teacher must not only have the knowledge of the goal and what to teach (subject matter) but how to teach effectively (pedagogical skills). Teachers knowledge of hands – on activities would lead to increased retention, engagement, extra practice, risk mitigation, benefits of different learning styles and improved problem solving skills among children with intellectual disabilities.

Franklin and Peat (2005) assumed that working in a hands-on way provides a more realistic and exciting experience of the content to children. Inadequate knowledge of hands – on activities by teachers would not make learning realistic, exciting and accomplished for

children with intellectual disabilities. With the use of hands-on activities learning becomes more promising and rewarding for children with intellectual disabilities because they tend to gain more on the use of visual and kinaesthetic activities which would lead to self-reliance and self-dependence and eventually self-employment.

The second finding in this study showed that the extent of teachers' use of hands-on activities in handling children with intellectual disabilities is low. This might be as a result of non-availability of instructional materials in the schools observed which might have incapacitated the teachers to engage the children in hands-on activities. It could also be as a result of the quality of teachers in the school where most of them are not qualified and untrained. This finding is in contrast to the assertion Salami, (2009) that children learn best when learning is active, when they are engaged in hands-on activities, and involved in what they are learning with the low level of teachers use of hands-on activities the position of scientists according to Wagner, Newman, Cameto, Garza, & Levine (2005) that when children use all of their senses it helps the brain create pathways that make it easier and quicker to retain information was negated. According to Newman, Wagner, Cameto, Knokey and Shaver (2010), the lowest percentage of students from any disability category attending postsecondary education has been that of learners with intellectual disability but with this finding this may be difficult to achieve unless teachers engage in the use of hand-on activities in teaching students with intellectual disabilities in Ilorin metropolis.

Conclusion and Recommendations

The study concluded that teachers' knowledge of hands-on activities in handling children with intellectual disability is poor and the extent of use of hands-on activity in handling children with intellectual disability is low. Therefore, based on the findings of this study the following recommendations are made:

1. Teachers at pre-primary school level should be constantly trained and retrained on instructional strategies for handling children with intellectual disability or others special needs.
2. Qualified and professional teachers should be employed at this level of education in order to ensure professional delivery of their duties as teachers.

3. Instructional hand-on materials should be provided by government, schools and teachers so as to enhance the use of hands-on activities with children with intellectual disability in the classroom.

References

Adigun J., Onihunwa J., Orunokhai E. and Sada Y. (2015). Effects of gender on student academic performance in computer studies in secondary school in New Bussa Borgu Local Government of Niger State. *Journal of Education and Practice,* 6(33)

Bilgin, İ. (2006). The effects of hands-on activities incorporating a cooperative learning approach on eight grade students' science process skills and attitudes towards science. *Journal of Baltic Science Education,* 1(9), 27-37.

Bristow, B. R. (2000). The effects of hands-on instruction on 6th grade students' understanding of electricity and magnetism. *Dissertation Abstracts International, 39*(01), 30A (UMI No. AAT 1400301).

Charles G.E., Madu S. and Adigun F.A (2016). Appraisal of the Implementation of Early Childhood Education in Owerri Education Zone 1 of Imo State, Nigeria. *Journal of Research and Methods in Education*, 6(2), 80-85

Cooperstein, S. E., & Kocevar-Weidinger, E. (2004). Beyond active learning: A constructivist approach to learning. *Reference Services Review*, 32(2) 141-148.

Coştu, B., Ünal, S., & Ayaş A. (2007). A hands-on activity to promote conceptual change about mixtures and chemical compunds. *Journal of Baltic Science Education, 6*(1), 35-46.

Dada, O. C. (2015). Intellectual Disabilities : A conceptual approach. Arinak : Ibadan

Early, D.M. & Winton, P.J. 2001. Preparing the Workforce: early childhood teacher Preparation at 2-and-4-years institutions of higher education. U.S.A.*: Early Childhood Research Quarterly 16,285-306.*

Ede, F. 2003. The role of teacher education in national development. *Eha-Amufu school of Education journal, 3.1.*

Engestrom, Y., Miettinen, R. and Punamaki, R.L. (1999). Perspective on activity theory. Cambridge University press. 2nd Ed. Retrieved May 7, 2009, from http://books.google.com/books?id=GCVCZy2xttD4c

Gardner, H and Hatch, T. 2004. Educational implications of the theory of multiple intelligence – *Educational Research,* 18 (8), 4-10.

Gibbons MM, Cihak DF, Mynatt B, Wilhoit BE (2015). Faculty and student attitudes toward postsecondary education for students with intellectual disabilities and autism. *Journal of Postsecondary Educ. Disability*. 28 (2):149-162

Haegele JA, Park SY (2016). Utilizing generalization tactics to promote leisure-time physical activity for students with intellectual disabilities. *Strateg. J. Phys. Sport Educators* 29 (4),19-23.

Harris, J. C. (2006). *Intellectual disability: Understanding its development, causes, classification, evaluation, and treatment*. New York: Oxford University Press.

Heikura, U., Taanila, A., Olsen, P., Hartikainen, A. L., von Wendt, L., & Jarvelin, M. R. (2003). Temporal changes in incidence and prevalence of intellectual disability between two birth cohorts in Northern Finland. American Journal of Mental Retardation, 108, 19–31.

Kemple, K.M., Harthe, L.C., Coorrea, V.I & Fox Lise 2007. Preparing Teachers for Inclusive Education: the Development of a Unified Teacher Education Program in Early Childhood and Early Childhood Special Education. http://tes.sagepub.com/content/17/1/38.abstract Retrieved 17/7/2012

King, B. H., Toth, K. E., Hodapp, R. M., & Dykens, E. M. (2009). Intellectual disability. In B. J. Sadock, V. A. Sadock, & P. Ruiz (Eds.), Comprehensive textbook of psychiatry (9th ed., pp. 3444–3474). Philadelphia: Lippincott Williams & Wilkins.

Marc J. Tasse, Ruth Luckasson, and Robert L. Schalock (2016). The relationship between intellectual functioning and adaptive behaviour in the diagnosis of intellectual disability. 54(6), 381-390

Newman,L., Wagner,M., Cameto,R.,Knokey, A., & Shaver,D. (2010).Comparisons across time of the outcomes of youth with disabilities up to 4 years after high school. A report of findings from the National Longitudinal Transition Study (NLTS) and the National Longitudinal Transition Study-2 (NLTS2) (NCSER 2010-3008). Menlo Park, CA: SRI International

O'Neil, B. (2004). Improving learning for underachievers. *The Clearing House, 74*(5) 236-237

Salami, I.A. 2009. An investigation into teaching methods in primary mathematics teacher training institutions. A paper presented in an International conference on Education for Sustainable Development, Faculty of Education, University of Ibadan May 18-22, 2009.

Turpin, T. J. (2000). A study of the effects of an integrated, activity-based science curriculum on student achievement, science process skills, and science attitudes. *Dissertation Abstracts International,* 61(11), 4329A (UMI No. AAT 9993727).

UNESCO 2008. *The Contribution of Early Childhood Education to a Sustainable Society* Paris: UNESCO. United Nation (n.d*.) Fiftieth Anniversary of the universal declaration Of human rights.* Retrieved July 12, 2013, from http://www.un.org/rights/50/decla.htm

Wagner, M., Newman,L., Cameto, R.,Garza, N., & Levine, P. (2005).After high school: A first look at the postschool experiences of youth with disabilities. A report from the National Longitudinal Transition Study-2 (NLTS2). Menlo Park, CA: SRI International. Retrieved from www.nlts2 .org/reports/2005_04/nlts2_report_2005_04_complete.pdf.

Winthrop, R., Williams. T.P. & McGivney, E. (2016). Accelerating progress in education with hands-on, minds-on learning. Brookings : Washington DC.

SMART PHONES AS TOOLS FOR TEACHING AND LEARNING MATHEMATICS: A CASE STUDY OF TWO MATHEMATICS TEACHERS IN TAUNG AREA

J. Owusu-Mensah

Vaal University of Technology, South Africa

Email: jameso@vut.ac.za

Abstract

The advent of Technology has undoubtedly made life easier. Information can be received and shared within seconds through the use of technology. The contribution of technology to the education system in particular is quite remarkable. However, the use of devices such as smart phones in the classroom has not been fully exploited by students and teachers. This study looked at the extent to which smart phones can be used in teaching and learning of mathematics to increase students' participation and performance. The study is focused on the Further Education and Training (FET) phase. The case of two high school mathematics teachers in the Taung area of the North West Province, South Africa, are presented. These teachers have encouraged students to use smart phones as learning tools in and outside the classroom and furthermore, the schools they teach have been provided with the necessary resources, such as WIFI facility. While one of these teachers report of observing favourable changes in his students as a result of the use of their smart phones, the other one could not see any significant changes in her current students. However, her previous students did show some progress after using the smart phones. The study therefore concluded that the use of smart phones in mathematics classes do not necessarily improve students' performance. Lessons learned from the study are that, for technology to be an effective tool of learning depends on the commitment of the learner and the purpose for which device is used.

 Keyword: Smart phones, technology, teaching and learning, mathematics, WhatsApp, Internet

Introduction

Technology is powerful and it can be used in several ways to make teaching and learning powerful and exciting. Usually what can be done with technological devices is limited basically by the creativity of the user. Hence the more creative and innovative we get, the more results we will see using technology in class. In South Africa, teachers have been encouraged to use technology in teaching. In order to make this a reality, the government has deployed technological tools in schools. For example, in the North West Province, schools

have been provided with iPads, laptops and some form of connectivity like WIFI or data bundles.

Smart phones have been a popular device among most students. They are easily available and now forms part of the culture and daily life of any teacher and student. It is therefore likely to become highly useful for both teachers and students. There are a lot of literature on how the use of technological devices, such as smart phones, do support teaching and learning. For example, Fies (2007) and Warschauer, (2007), have reported that the use of technology increases students' motivation and engagement. These authors (Fies 2007, Warschauer, 2007) also mentioned that the use of smart phones increases accessibility and high retention of the user. However, many teachers still believe that smart phones have no place in the classroom. Some teachers believe that a cell phone is not e-learning or m-learning tool. It is a disruptive toy and has no place in a learning environment.

Regardless of schools' policy on the use of cell phones at school, the reality is that in most schools, students have phones on them. These phones could be used for a good purpose as far as teaching and learning of curriculum is concerned. In this research, the case of two high school mathematics teachers from Taung district in the North West Province of South Africa, who have incorporated the use of smart phones in their classrooms are reported. The choice of these teachers comes from their interest in the use of technology in teaching and the availability of resources such as laptops and WIFI facility installed in their schools. Furthermore, most studies on mobile phone use for academic purposes have been on university or post-secondary students.

Conceptual Framework

The study adopted the technology Acceptance Model (TAM). This model describes how a technology may be adopted to improve performance of a particular activity. Chuttur (2009) has described TMA as the most influential model for testing information system. TAM helps to assess how potential users of a particular technology come to accept and use it. In this study, the model assisted in assessing the use of smart phones by mathematics teachers and how they perceived the usefulness of this device in teaching and learning.

Literature review

The use of cell phones in teaching and learning is accepted as positive development in education. We are in the digital age, let's work with it not against it. Many students do not realise they have tools in their pockets not just text machines. This sentiment is echoed by Mtega, Bernard, Msungu and Sanare (2012) who confirmed that currently the use of mobile communication devices has gone beyond the traditional communication role that it is now used in supporting teaching and learning. According to these authors, mobile learning applications can assist students, not only learning contents conveniently, but also interacting with others collaboratively anytime and anywhere. Hence, the development of mobile learning as a new strategy for education has implications for the way students and teachers in educational institutions interact. Mtega et al (2012) found that the major common academic use of mobile phone is SMS. In the study it was also established that most of the students use their phones for calls and WhatsApp messages. Other mobile learning applications such as camera, voice calls, emails, Google drive are used to create, upload, download and share academic resources with their friends. Integrating smart phones in the classroom is therefore a good teaching-learning strategy that is adopted to keep student-centred pedagogy.

Norries, Hossain and Soloway (2011) affirmed that students' achievement increase significantly, when they use mobile learning devices, including smartphones, during learning time. Woodcock, Middleton and Nortcliffe (2012) have also reported that smartphones allow students to improve productivity and eventually their learning performance. Despite many current studies reporting on the the benefits of smart phone usage in learning, other researchers, such as Woodcock, Middleton & Nortcliffe (2012), White and Mills (2014) have demonstrated contrasting views. Jacobsen and Forste (2011) carried out a study on smart phone use in relation to academic performance and found a negative relationship between calling, texting, and self-reported grade point average (GPA) among students. Sarfo and Ansong-Gyimah (2010) report on some empirical studies found that technology (such as computer) does not directly improve learning. Lepp, Barkley, and Karpinski (2015) affirmed that students who used smart phones more on a daily basis were likely to have a lower grade point average than students who used it less. This is because smart phone use is not only limited to calling and texting. Other uses like as Internet, email and social-networking such as Facebook can potentially be an interference during academic activities. A recent study on college students by Tossell, Kortum, Shepard, Rahmati and Zhong (2015) found that smart

phone use was perceived as favourable prior to the study. However, it was later revealed that students view smart phones as detrimental to their educational goals in the end. This indicates that the perceived benefits of the use of smart phones as learning tools are inconclusive. The current study therefore examines the extent to which smart phones can be used to increase students' participation and performance in mathematics.

Foens, Hassan, Nor and Malek (2017) examined the extent to which students in one Malaysian University use smart phones to support their school performance and how these activities relate to Cumulative Grade Point Average (CGPA). The study found that the more students utilised their smart phones for learning activities, the lower their CGPA. In a another study by Woodcock et al (2012), it was also found that students who own smart phones are largely unaware of their potential to support learning and, in general, do not install smartphone applications for that purpose.

The use of smart phones in schools also pose some social challenges. Lynch (2015) mentioned that providing smart phones for each student is a big financial cost to the schools. On the other hand, where students are to bring their own device may draw attention to situations where some students are more privileged than others may, and there is always a potential for theft.

Research Design

This study is a case of two high school teachers who have used smart phones in teaching and learning mathematics in their respective classes. The research design used is a descriptive and interpretive case study that was analysed through qualitative methods. The research question is: "Can smart phones be used in teaching and learning in high schools to improve student participation and performance in mathematics?"

Semi-structured interviews were the main data collection technique used. Data analysis was done just after the data collection. The content analysis was employed in this qualitative research. The following themes emerged from the interviews: teachers' experience in the teaching of mathematics, teachers experience in smart phone usage, challenges encountered, participation and performance.

The results of the semi-structured interviews of the teachers are presented below:

Teacher A

This teacher has taught mathematics for the past 12 years in one of the remote areas in the Taung district. About three years ago, he decided to introduce smart phones as a teaching and learning tool in his grade 12 mathematics class. I asked him, **"Why did you decide to use smart phones in your mathematics class?**

According to this teacher, the decision to use smart phones in his class came from the motivation he had from one of the workshops for mathematics teachers. I then asked him how the smart phones are used to support learning. His response was that "since I am very well informed in the use of smart phones, I first formed a WhatsApp group with all my students who have access to a smartphone". Those students who do not have their own phones tried to use those of their parents. I made them aware that the WhatsApp platform is strictly for academic purposes and that no one should attempt to use it for any form of entertainment.

He said that he will occasionally post a problem or two and expect the students to find solutions. Home works and assignments are usually posted on the platform, he added. He mentioned that he always insists that he will not jump in to give solutions until he has seen the efforts made by the students. The WhatsApp platform has also been used for communicating information to the students. For example, if on a particular day when I will not be in school, I will inform the students on WhatsApp and ask them to do a particular exercise from their textbooks. I do encourage my students to work in groups so that they help one another. This teacher also mentioned that during class discussions, he usually encourages students to demonstrate how a particular problem can be solved in different ways.

I then asked him, "**how has the use of smart phones in class helped to improve your students' performance".**

By using their smart phones for learning, this teacher claims that he has observed some changes in his students. Some of them can now access the YouTube for more information on various topics. Such practices, according to this teacher has encouraged most of his students to do self-study and this has improved their participation in class. Most students now have the confident to ask and to answer questions in class than before they were encouraged to used their smart phones for academic purposes. Even though the matric (grade 12) results for mathematics have not had any significant improvement, this teacher believes that the incorporation of technology in teaching and learning has brought some significant

improvement in the students' behaviour. For instance, students now have fully embraced the idea of group work and their communication skills have improved.

What are some of the challenges you face in incorporating smart phones in your teaching?

This teacher indicated that one of the challenges faced by integrating the use of smart phones in teaching and learning is that some students may not have the device. He said, "Sometimes I ask those who have it to share with others, but not everyone is prepared to share". Most of the parents in the community find it difficult to provide their children with smart phones due to economic reasons (Lynch, 2015). In addition to that, the provision of mobile data for connectivity to the Internet is a big challenge to the use of such devices. The teacher also mentioned that some students prefer not to bring their smart phones to school, because they fear that they might be stolen.

Teacher B

This teacher has taught mathematics for the past 14 years in one of the schools in Taung central. Currently, she is the HOD of Maths and science departments and teaches grade 11 and 12 mathematics. For the past three years, she has been using the smart phone as a teaching and learning tool in her mathematics classes.

I asked her why she decided to use smart phones in her class.

She indicated that prompted her to incorporate smart phones in her lessons was that she had observed that many of her students will come to school with these devices and they will be "playing" with them while she is busy teaching. According to her, she felt that these students were not focusing on what she is teaching but rather on their smart phones. She then thought of how these devices could be integrated in teaching and learning. According to this teacher, she usually accesses information of various mathematics topics from YouTube. She believes that such information has helped her to improve her presentation and instructional strategies. She therefore thought of passing on some of her knowledge in using smart phones to her students, especially for academic purposes.

How do you use smart phones to support students' learning?

This teacher indicated that she has taught those students with smart phones how to access videos of some mathematical topics from the YouTube. In addition to that, she also

mentioned that she has created a WhatsApp group for her grade 12 students where they share information for academic purposes. Since her school has a WIFI facility, she often allows students to use their phones in class, however, with specific instructions and she goes round to see if students are doing exactly what they are supposed to do.

How has the use of smart phones in class helped to improve your students' performance?

In terms of improvement of results, this teacher claims that not much has been achieved for the 2017 cohort. She reported that the school had a 58% pass in mathematics in the 2017 matric results as compared with 65% and 68% for 2015 and 2016 respectively.

What are some of the challenges in incorporating smart phones in teaching and learning?

This teacher mentioned that students usually prefer to use their smart phones for entertainment rather than for academic purposes. In addition to that, it is always difficult to get their attention when they are using these phones.

Findings and discussion

In many communities in South Africa, not every classroom can afford to get laptops so devices such as smart phones become very useful for teachers in the classroom. Mtega, et al (2012) affirmed that the most common ICT tools owned and used among people are mobile phone. Even though some of the students may not have smart phones of their own, they can always share with others. Students whose parents have smart phones could also have access to those of their parents. Even though the number of students with smart phones have increased over the last couple of years, there are students in many rural schools who do not have access to such devices (Lynch, 2015). Smart phones could be considered as personal technology and most students have invested a great deal of time learning about their features, how to navigate and the limitations thereof. Learning on the phone can be extended beyond the school premises.

With the advent of smart phones, many school authorities have policies on the handling and usage of these devices in the classroom. Some of these measures are to minimise theft and to avoid unnecessary disturbance in class resulting from incoming calls (Lynch, 2015). It is always assumed that students use their smart phones to text friends or update their various

social media sites. However, teachers need to be innovative to find ways to ensure that students use their smart phones for educational purposes both in and out of school. Change the classroom dynamic from lecturing at the front of the classroom to having no traditional front of the classroom at all. It's harder for students to do the negative behaviours when the phones are out and the teacher is walking around.

The study found that even though smart phones are now very popular, not all students have access to these devices. This is basically due to the socio-economic conditions of majority of the parents in this area. Most of the parents in Taung area are not working and rely on the monthly grant form government. In order to overcome this challenge, it is advisable that teachers encourage working in small groups so that students who don't have smart phones can share with others.

Most of the students were not aware of the capacity of their smart phones. Some of the students just used their devices for calls and text messages since they did not know other applications supported by their smart phones. WhatsApp appears to be the most common platform where information is shared between a teacher and a student, and between students. This is affirmed by Mtega et al (2012) that the major and common academic uses of smart phones is WhatsApp (SMS). This is partly because it is free to download and does not usually require a much sophisticated phone. The use of smart phones in class have exposed many students to other applications, such as obtaining learning materials from YouTube. Both teachers and students access information from the YouTube. This allows the students to view a particular lesson as many times as possible at any time. Hence learning is assumed to take place any time anywhere. However, there is no guarantee that students will use their smart phones for academic purposes only. It is highly tempting that some students may use their smart phones for entertainment rather than for curriculum issues.

One of the major challenges that study found was the cost of data for connectivity. In order to obtain information from YouTube or to access learning materials the Internet, one needs to buy data. Hence a student may have a smart phone but may not be financially sound to buy data all the time. The frequent buying of data bundles to access information is a big challenge to most of the students. Some school authorities have installed WIFI facilities in their schools

to help students get easy access to the Internet. However, this facility can be used only when the student is in school.

The use of smart phones in school have prompted school authorities to increase their security measures so that the stealing of these devices are avoided. However, one of the teachers said: "Sorry but I don't trust my students with cell phones. They already steal from even their most favourable teachers and destroy the computer lab if they are not closely monitored".

In the study, it was found that students' participation in class have improved as a result of the use of smart phone. Most of the students can now post their questions on the WhatsApp platform and collaboration among students have also improved. However, this could not translate into improvement in their performance at matric examinations. The two teachers in the case study could not affirm that the use of smart phones in teaching and learning has improved their students' performance in mathematics. In fact, the extent to which smart phones have contributed to improved academic achievement in these schools is still inconclusive. This situation is consistent with the studies by Sarfo and Ansong-Gyimah (2010) who found that technology does not directly improve learning.

Conclusion

The effective and successful use of smart phones in teaching and learning depends on many factors. The study found that there is no guarantee that incorporating smart phones in teaching and learning necessarily imply improvement in performance. It is not easy for teachers to monitor how students use their smart phones especially when they are out of school premises. Furthermore, improvement in academic performance depends on many factors which includes prior knowledge and experience of the learner and the commitment of the learner as far as academic activities are concerned. The study concludes that while the use of smart phones may increase students' participation in teaching and learning, this may not necessarily translate into improvement in performance.

Recommendations

The study recommends that teachers be trained to acquire the knowledge and skills that could assist them to download the necessary applications on their smart phones for academic purposes.

It is also recommended that schools should endeavour to install WIFI facilities in their premises to ease to financial burden of buying data bundles by students in order to access information from the Internet.

The study further recommends that teachers adapt to the changing times and find a way to successfully incorporate these devices into their classrooms.

References

Chuttur, M.Y. (2009). Overview of the Technology Acceptance Model: Origins, Development and Future Directions. Indiana University, USA. Sprouts: *Working Papers on Information Systems 9(37).* http://sprouts.aisnet.org/9-37.

Fies, C. (2007). Research Summary: Digital technologies in mathematics and science education. Retrieved May 5, 2015, from http://www.nmsa.org/ResearchSummasries/DigitalTechnology/

Foen, S., Hassan, N.S., Nor, N.H.M, & Malek, N.A. (2017). The Relationship Between Smartphone Use and Academic Performance: A Case of Students in a Malaysian Tertiary Institution. *Malaysian Online Journal of Educational Technology. 5(4): 58-70*

Jacobsen, W.C., & Forste, R. (2011). The wired generation: Academic and social outcomes of electronic media use among university students. *Cyber psychology, Behaviour, and Social Networking, 14, 275-280.*

Lepp, A., Barkley, J.E. & Karpinski, A.C. (2015). The Relationship Between Cell Phone use , Academic Performance, anxiety and Satisfaction with the Life in College Students. *Computer in Human Behaviour, 13(0): 343-350.*

Lynch, M. (2015). Do mobile devices in the classroom really improve learning outcomes? *The Conversation.* http://theconversation.com/do-mobile-devices-in-the-classroom-really-improve-learning-outcomes. 38740 Retrived on 28 august 2018.

Mtega, W.P., Bernard, R., Msungu, A.C. & Sanare, R. (2012). Using Mobile Phones for Teaching and Learning Purposes on Higher Learning Institutions. The case of Sokoine University of Agriculture in Tanzania. *Proceedings and report of the 5th UbuntuNet Alliance annual conference, 2012 pp 118-129.*

Norries, C., Hossain, A., & Soloway, E. (2011). Using smartphones as an essential tool for learning: A call to place schools on the right side of the 21st century. *Educational Technology, 51(3), 18-25.*

Sarfo, F.K. & Ansong-Gyimah, K. (2010). The perceptions of students, teachers and educational officers in Ghana on the role of computer and the teacher in promoting the first principles of instruction. *The Turkish Online Journal of Educational technology, 9(3): 85-95.*

Tossell, C.C., Kortum, P.,Shepard, C., Rahmati, A., & Zhong, L. (2015). You can lead a horse to water but you cannot make him learn: Smartphone use in higher education. *British Journal of Educational Technology, 46, 713-724*

Warschauer, M. (2007). A teacher's place in the digital divide. *Yearbook of the National Society for the Study of Education, 106, 147-166.*

White, J., & Mills, D.J. (2014). Examining attitudes towards and usage of smartphone technology among Japanese University students studying EFL. *CALL-EJ 15(2):1-15.*

Woodcock, B., Middleton, A., & Nortcliffe, A. (2012). Considering the smartphone learner: An investigation into student interest in the use of personal technology to enhance their learning. *Student Engagement and Experience Journal, 1(1),1-15.*

PRINCIPALS' GENDER AND THEIR MANAGERIAL EFFECTIVENESS IN FEDERAL CAPITAL TERRITORY SENIOR SECONDARY SCHOOLS, ABUJA, NIGERIA

Folashade Roseline Ogunshola

National Open University of Nigeria, Abuja, Nigeria

follyshaddy@yahoo.com

Abstract

This study examined the principals' gender and their managerial effectiveness in Federal Capital Territory (FCT) senior secondary schools, Abuja, Nigeria. The study adopted the descriptive survey research design. The study used a sample of 940 respondents in public and private senior secondary schools in FCT. Stratified sampling technique was used to select 940 teachers in the sampled schools. To ascertain the validity of the instrument, content validity was adopted. The questionnaire was pilot-tested and reliability coefficient of 0.85 was obtained. The mean score and standard deviation were used to answer the research question while t-test was used to test the hypothesis at 0.05 level of significance. The study revealed that the principals were effective in all the six areas of managerial effectiveness. The study also showed that there was no significant difference between the managerial effectiveness of male and female principals in FCT senior secondary schools. It was concluded that the principals' gender did not influence their managerial effectiveness in FCT senior secondary schools. It was, therefore recommended that, government should help to improve the principals' managerial effectiveness in different areas of managerial skills through seminar, workshop and in-service training for better management of senior secondary schools in FCT.

Keywords: Principals' Gender, Managerial Effectiveness, Senior Secondary Schools.

Introduction

The increasing development of the educational system at all levels brings greater demands on educational practitioners such as curriculum planners, evaluators, principals and teachers in their press to move along with the effectiveness in educational management of the 21st century. The secondary education level occupies a critical position in the educational system. "Secondary education is the education children receive after primary education and before the

tertiary stage: the broad goals of secondary education are preparation of the individual for useful living within the society and higher education" (Federal Republic of Nigeria (FRN), 2004, p. 18). Secondary education is of six years duration, given in two stages: three years junior secondary school and three years senior secondary schools.

The achievement of the secondary education goals is dependent on the extent to which the principals are able to apply the appropriate managerial processes in the school operations. Improved secondary education is essential to the creation of effective human capital in any country (Evoh, 2007). The need for managerial effectiveness of principals in Federal Capital Territory (FCT) senior secondary schools cannot therefore, be overemphasized. Management effectiveness refers to characteristics that deal with organizational issues and management actions on the staff within organizations (Balduck&Buelen, 2008). The school managers (principals) in Federal Capital Territory (FCT), Nigeria need to be well informed about the importance of managerial effectiveness in senior secondary schools for effective management. This might be necessary in the areas of curriculum development and implementation, students' management, school personnel management, management of school plant and facilities, school financial management and management of school-community relationship.

School managers as the leaders of their institutions need to actively initiate practical actions for relevant educational changes and innovations into their managerial functions for effective management. A leader is someone who influences a group of people to achieve a specific goal. According to Okorie (2002) leadership is getting the job done through people. Peretomode(2001) described leadership as the process of providing direction and influencing individuals to achieve goals. Effective leadership involves identifying goals and the means to achieving them; it is not the exercise of power (Hadden, 2008). The personal variables of a leader remain essential factors in the management of the school. However, gender, experience, ownership of school and the likes are factors that determine the extent to which a principal is able to achieve the school goals and objectives. Okorie (2002) noted that principal's personal characteristics which include age, marital status, teaching experience, academic qualifications and sex cannot be divulged from the way and manner at which the school is being managed. Therefore, the study was set out to examine the principals' gender and their managerial effectiveness in Federal Capital Territory senior secondary schools, Abuja, Nigeria.

Statement of the problem

There are developments in the senior secondary schools in FCT, Nigerian which indicate some level of managerial effectiveness. There is no doubt that secondary education has become more complex, thus, its management demands more from the principals. Some schools experience more conflicts than others in the areas of management and this may be attributed among other things to the gender of the principal and his/her level of leadership (Adesina, 1990). There is a lot of work in the senior secondary school system to be covered by the principals but this study focuses on the managerial effectiveness of the principals in the area of curriculum development and implementation, students' management, school personnel management, management of school plant and facilities, school financial management and management of school-community relationship. Also, Some of the challenges of principal managerial effectiveness observed by the researcher are as follows: poor/inadequate of school plants and facilities, inadequate/unqualified teachers, overcrowded classrooms, lack/inadequate of funds, lack/insufficient knowledge of Information and communication technology and over population of students especially in the public senior secondary schools. Therefore, this study examined the principals' gender and their managerial effectiveness in Federal Capital Territory senior secondary schools, Abuja, Nigeria.

Purpose of the study

Specifically, the study sought to achieve the following objectives:

1.   Establish principals' level of managerial effectiveness in FCT senior secondary schools.
2.   Determine whether there is any significant difference between managerial effectiveness of male and female principals in FCT senior secondary schools.

Research question

The following research question was raised:

1.   What is the level of principals' managerial effectiveness in FCT senior secondary schools?

Hypothesis

The following null hypothesis was formulated to guide this study:

Ho$_1$:   There is no significant difference between managerial effectiveness of male and female principals in FCT senior secondary schools.

Theoretical framework

This study considered Jenkins four quadrants of administrative effectiveness most relevant to provide a theoretical context for this investigation. These four quadrants of administrative effectiveness were formulated by Jenkins in 2010. He explained that few administrators are perfect examples of any single type of administrative effectiveness quadrant. Jenkins (2010) outlined four quadrants of administrative effectiveness as follows:

1. High responsibility, low control. People who fall under this quadrant usually make the best administrators, and are among the most liked, because of their willingness to accept responsibility. They are rarely self-promotional types, preferring instead to lead by example and refusing to ask of others what they would not do themselves. These administrators are highly effective because people trust them and believe they can count on them.

2. High responsibility, high control. Next is this group of administrators who are often well liked, even beloved, because they give everything they have to the job and everyone knows it. They may be a little controlling, worrying that everything is done correctly and on time but people tend to overlook the negative because they also take so much personal responsibility for everything. They can be effective to a degree, because they get things done even if they end up doing those things themselves, which is often the case.

3. Low responsibility, low control. The third administrative type is probably the least effective, though not the most despised. The problem is that, unlike their high-responsibility colleagues, the low-responsibility types tend to leave everything else alone, including their own duties. Basically, they are lazy. They don't want to do too much and they don't expect much of themselves, either.

4. Low responsibility, high control. The title of most-despised administrator belongs to this group of "leaders." They are also among the least effective. They demand the lion's share of the credit for any success, but they will quickly lay the blame for failure at the feet of someone else or anyone else. Despite constant talk of "teamwork," they are generally

reluctant to involve themselves in actual work. They also love to remind people that they are "the boss".

From the above, a good leader must adapt to the organization's culture and make sure his/her skills are aligned with organizational goals to achieve positive results. For the principal to be able to be more effective and efficient in his administrative functions, he is expected to ensure that he exhibits the qualities required of him to achieve secondary school goals and objectives. This study examined the managerial effectiveness of the principals in these following areas deduced from Udeozor (2004): Curriculum development and implementation, students' management, school personnel management, management of school plants and facilities, school financial management and management of school-community relations. Jenkins theory guided the researcher inthese six areas of school management todetermine the level of managerial effectiveness of the principals in FCT senior secondary schools.

Concept of managerial effectiveness

Management is the art of getting things done through people. Management is a process in which managers plan, organize, staff, direct, evaluate and control human, financial and material resources to achieve the stated organizational goals and objectives. Management is the art, skill and technique of getting things done through others effectively and efficiently (Nigerian Institute of Management (NIM), 2010). Effectiveness in school management is judged by how well objectives of education are realized and not by some real or imagined standards for the proper management of schools. Effectiveness is also the accomplishment of the set goals and objectives over a period.

Managerial effectiveness is a leader's ability to achieve desired results (Aimee, 2012). How well a leader applies his skills and abilities in guiding and directing others determines whether he can meet those results effectively. If he can, his achievements are poised to help the organization gain a competitive edge against rival organizations heading into the future. According to Mehta (2008), managerial effectiveness is often defined in terms of output-what a manager achieves. This result-oriented definition leads to three factors to be responsible for the results that an organization achieves through its managers. These are: (a) the efforts and

ability of the managers, (b) the environment in which the managers and the organization operates, and (c) the efforts and ability of the subordinates. Thus, the managers' ability is the key element in achieving the desired results. Managerial effectiveness is gauged by the results a leader achieves.

The principal as a manager

Successful operation of an educational institution requires competent managers. Education managers (principal) provide instructional leadership and manage the day-to-day activities of the schools. Accordingly, the principal is regarded as the chief executive of the school, who is responsible for all that, happens in the school (Oyedeji & Fasasi, 2006).They set educational standards and goals and implement the policies and procedures required to achieve them. They also support staff, teachers, counsellors, librarians, coaches, and other employees. They develop academic programs, monitor students' educational progress, train and motivate teachers and other staff, manages career counselling and other student services, administer record keeping, prepare budgets, and perform many other duties. They also handle relations with parents, prospective and current students, employers, and the community. Educational managers who manage secondary schools are called principals. Principals confer with staff to advise, explain, or answer procedural questions. They visit classrooms, observe teaching methods, review instructional objectives, and examine learning materials. Principals must use clear, objective guidelines for teacher appraisals, because principals' pay often is based on performance ratings.Some of the managerial functions of a school principal according to Ogunsaju (2002) are as follows: planning, organizing, staffing, motivating and evaluating.

Gender and principals' managerial effectiveness

The personal variables of a leader remain essential factors in the management of the school. However, gender, experience, ownership of school and the likes are factors that determine the extent to which a principal is able to achieve the school goals and objectives (Ogunshola & Adeniyi, 2017). Okorie (2002) noted that principal's personal characteristics which include age, marital status, teaching experience, academic qualifications and sex cannot be divulged from the way and manner at which the school is being managed. Gender difference, a product of institutions, emanates from institutionalized patterns of distributing resources social value and power in public and private spheres worldwide (Matheri, Cheloti & Mulwa, 2015). Thomas (2004) stated that research has demonstrated that there are far more similarities than differences in the

leadership behaviours of women and men, and that they are equally effective. Still, women are less likely to be pre-selected as leaders, and the same leadership behaviour is often evaluated more positively when attributed to a male than to a female. Alhourani (2013) argues that gender does not impact on leadership effectiveness, which implies that was no significant effect of gender on leadership effectiveness. Thus, women leaders were as effective as men leaders in the institutions where the research was done.

Areas of principals' managerial effectiveness

This study adopted Udeozor (2004) specifications of principals' role performance as a manager are: curriculum development and implementation, students' management, school personnel management, management of school plants and facilities, school financial management and management of school-community relations.

a. Curriculum development and implementation: The task area of curriculum development forms an important role of educational management. The principal works with the supervisor, teacher, students and parents in the selection of appropriate or desirable curricular or school activities, choice of subjects to be taught in the school, the textbooks, teaching aids and facilities, teaching method, the method of evaluation and ways of reporting on students' progress.

b. Students' management: Every student in the school system has his/her personal needs, aspirations or characteristics. The principal has a lot of task towards the satisfaction of the students' needs. These tasks are: providing boarding facilities to the students; the provision of social and outdoor activities for social, physical, emotional and intellectual development of the students; provision of good feeding and provision of health facilities; provision of guidance and counseling services; managing discipline among students, here the principal takes the issue of discipline very seriously; and handling students' records and progress report and orienting new students.

c. School personnel management: This is the most crucial role of a school manager.This is management of human resources. The school is a result-oriented organization. The personnel need to be managed prudently. Specifically, the following roles must be carried out; as recruitment, selection and placements. In most public school systems across the country, the staff of the schools are usually recruited by the appropriate authorities and posted to schools.

After this exercise the school head place the staff to appropriate need areas where their services could be utilized optimally. Selection and placement of tutorial staff reflects their areas of specialization and experience on the Job.

d. Management of school plant and facilities: This is another very important task area of the school administrator. He deals primarily with the school physical environment with the aim of providing conducive physical learning environment. This aspect of the administrator's roles refers to the act of procuring and organizing the physical resources of the organization in a very effective manner so that the goals of the organization will be achieved. His major responsibilities in this dimension call for adequate care of the plants and facilities, involving the entire school personnel in their maintenance, devising supervisory schedules to avoid neglect of the plants and facilities, procuring adequate quantity and quality of school personnel. These responsibilities would enable the school plants and facilities function at the optimum capacities and creating awareness among the staff regarding the importance of well kept school plants and facilities.

e. School financial management: This aspect of the administrator's tasks involves money that is how to get money and how to utilize the money for school educational programmes. This function include: organizing the business staff, preparing the school budget, administering capital outlay and debts services, administering school purchases, accounting for school monies and property, providing for a system of internal accounting.

f. Management of school-community relations: The school is a social system within a wider social system, the community. The school accommodates the school administrator, the teachers, the non-tutorial staff and students. All these individuals are affected in one way or the other by certain events happening in the community. The school community in this regard, can be used to describe the immediate local community of the school, the parents, religious organizations and other educational agencies that have to do with the school. The school manager finds himself dealing with various Individuals from the community. The need arises for him to tap good leadership qualities in establishing mutual understanding, cordial and cooperative relationship between the school and the community.

Challenges of principals' managerial effectiveness in senior secondary schools in FCT
Some of the challenges of principal managerial effectiveness observed by the researcher are

as follows: poor/inadequate of school plants and facilities, inadequate/unqualified teachers, overcrowded classrooms, lack/inadequate of funds, lack/insufficient knowledge of Information and communication technology and over population of students especially in the public senior secondary schools.

Methods/techniques

This study adopted the descriptive survey research design. This method was used to elicit responses from a sample of principals FCT senior secondary schools. The population of this study consisted of all the 187 senior secondary schools (public and private) in FCT. The sample of the study was made up of 94 senior secondary schools in FCT. Stratified sampling technique was used to select the 94 senior secondary schools based on 50% public and 50% private. A total number of 30 public senior secondary schools and 64 private senior secondary schools were selected. Thus, a total number of 94 principals and 940 teachers were randomly selected from the Federal Capital Territory senior secondary schools as sample for the study. The total sample of principals and teachers in public senior secondary schools obtained were 30 principals and 300 teachers while the total sample of principals and teachers in private senior secondary schools obtained were 64 principals and 640 teachers.

Instrument

In this study, a questionnaire was designed to elicit information from the respondents. The questionnaire was tagged "Principal's Managerial Effectiveness Questionnaire" (PMEQ). This was administered to teachers and they rated the managerial effectiveness of the principals. Furthermore, the PMEQ consisted of two sections (A - B). Section A covered item 1, which was used to obtain information of principals' gender while section B covered six areas of principals' managerial effectiveness such as: curriculum development and implementation, students' management, school personnel management, management of school plant and facilities, school financial management and management of school-community relations. The respondents were required to answer the items on a 4 point Likert rating scale, ranging from 4 to 1 as follows: Very effective is 4 points, Effective is 3 points, Fairly effective is 2 points and Ineffective is 1 point. The respondents were required to thick (√) against the rating that reflects their opinion about their principals' managerial effectiveness. PMEQ was pilot-tested and reliability coefficient of 0.85 was obtained using

Cronbach alpha. Since the reliability coefficients of .81 to .90 signifies good reliability (Tavakol & Dennick, 2011), the questionnaire was accepted as reliable for the study. Thus, 929 out of 940 (98%) of the instruments were returned and used for data analysis.

Data analyses techniques

In this study, the mean score and standard deviation (SD) were used to answer the research questions while the t-test was used to test hypothesis. The decision rule the for interpretation of the results of the data analysis was that a mean score of 2.50 and above was considered as a positive response (effective), and less than 2.50 was considered as a negative response (ineffective). The hypothesis was tested at 0.05 level of significant. The calculated probability (p-value) that was greater than the significant level of 0.05 was accepted while the p-value that was less than the significant level of 0.05 was rejected.

Results

What is the level of principals' managerial effectiveness in FCT senior secondary schools?

Table 1: Rating of Principals' Managerial Effectiveness (N=929)

S/No	Items	Mean	SD	Remarks
	Part I: Curriculum Development and Implementation			
2.	Principal in co-operation with his/her teachers define objective for the school and the departments.	3.12	0.76	Effective
3.	Principal jointly with the teacher select learning experience, method and procedures to employ in achieving the school objectives.	3.10	0.78	Effective
4.	Principal supervises teaching and learning activities in the class room.	3.03	0.81	Effective
5.	Principal assigns subject and class to teachers according to qualification and competence.	3.00	0.81	Effective
6.	Principal evaluates the planning and implementation of curriculum programmes.	3.45	0.77	Effective
	Average	**3.14**	**0.80**	**Effective**
	Part II: Management of Students			
7.	Principal's management of student services (e.g. records, reporting).	3.18	0.77	Effective
8.	Principal's management of student discipline.	3.26	0.74	Effective
9.	Principal's relationship with students (i.e. cordial).	3.27	0.77	Effective
10.	Principal counsels students when necessary.	3.30	0.79	Effective
11.	Principal encourages students to participate in school activities (e.g. sports events, debates society and so on).	3.56	0.64	Very Effective
	Average	**3.23**	**0.74**	**Effective**
	Part III: Staff Management			
12.	Principal encourages and enables appropriate professional development of staff.	3.10	0.81	Effective
13.	Principal communicates effectively with staff members about the school			

	activities.	3.23	0.81	Effective
14.	Principal delegates duties and authority to capable staff.	3.24	0.79	Effective
15.	Principal involves staff in decision-making and matters concerning them.	2.98	0.84	Effective
16.	Principal does not take side in conflict resolution.	3.02	0.83	Effective
	Average	**3.11**	**0.82**	**Effective**
	Part IV: Management of School Plants and Facilities			
17.	Principal provides the necessary and adequate school plants and facilities.	2.75	0.06	Effective
18.	Principal provides necessary equipment in the school laboratory for teaching and learning.	2.67	0.88	Effective
19.	Principals involves the school personnel in the maintenance of school plants and facilities.	2.93	0.79	Effective
20.	Principal always create awareness for the staff and the students on the importance of well kept school plants and facilities.	3.18	0.75	Effective
21.	Principal provides adequate instructional materials in the school library to enhance teaching and learning.	2.83	0.88	Effective
	Average	**2.87**	**0.67**	**Effective**
	Part V: School Financial Management			
22.	Principal jointly with the management staff and heads of departments prepare budget for the school.	2.66	0.91	Effective
23.	Principal plans and sources for funds for school improvement.	2.60	0.94	Effective
24.	Principal has a proper and accurate bookkeeping for financial information about the school.	2.66	0.91	Effective
25.	Principal gives true and fair view of the financial position of the school.	2.88	0.89	Effective
26.	Principal utilizes the school funds judiciously and ensures that budget reflects agreed goals and objectives.	2.93	0.84	Effective
	Average	**2.77**	**0.90**	**Effective**
	Part VI: Management of School-Community Relations			
27.	Principal works and relates well with community members and Organizations.	3.01	0.82	Effective
28.	Principal communicates with the community to obtain resources when necessary.	2.82	0.81	Effective
29.	Principal utilizes community communications to enhance school goals and objectives	2.77	0.80	Effective
30.	Principal engages in more community based activities or social activities.	2.61	0.89	Effective
31.	Principal involves the community members in the maintenance and repair of school plants and facilities when necessary.	2.48	0.90	Fairly Effective
	Average	**2.74**	**0.84**	**Effective**
	Overall Mean	**2.97**	**0.80**	**Effective**

Table1 shows the rating of principals' managerial effectiveness in FCT senior secondary schools. The average mean score of the six areas of principals' managerial effectiveness were higher than the 2.50 cut of point. Furthermore, the mean score of the principals in the six areas of managerial effectiveness in this study are as follows: 3.14 for the

curriculum development and implementation, 3.23 for the management of students, 3.11 for the staff management, 2.87 for the management of school plants and facilities, 2.77 for the school financial management and 2.74 for the management of school-community relations. Thus, the teachers' overall rating of the principals' managerial effectiveness had a mean score of 2.97 indicating that the principals were effective.

Hypothesis

Ho_1: There is no significant difference between the managerial effectiveness of male and female principals in FCT senior secondary schools?

Table 2: Analysis of Managerial Effectiveness of Male and Female Principals in FCT Senior Secondary Schools

Group	N	Mean	SD	df	p-value	Decision
Male	539	22.06	2.94			Ho_1
				927	0.157	Accepted
Female	390	18.78	1.83			

Note: df is degree of freedom i.e. N-2

Table 2 shows the t-test analysis of managerial effectiveness of male and female principals in FCT senior secondary schools. The p-value is greater than 0.05(5%) significant level, which means that there is no significant difference between the managerial effectiveness of male and female principals in FCT senior secondary schools. Therefore, the hypothesis was accepted.

Discussion of findings

From the data analysis, this study revealed that the principals were effective in all the six areas of the managerial effectiveness such as curriculum development and implementation, students' management, school personnel management, management of school plant and facilities, school financial management and management of school-community relationship. These principals fall under the "High responsibility, Low control" in the Jenkins (2010) quadrants of administrative effectiveness. This means that the principals who fall under this quadrant usually make the best administrators, and are among the most liked, because of their willingness to accept responsibility. They are rarely self-promotional types, preferring instead

to lead by example and refusing to ask of others what they would not do themselves. These administrators are highly effective because people trust them and believe they can count on them. These findings also agreed with the findings of Yawe (2007), that the principals were effective in all the six role areas under study in Benue State such as: curriculum development and implementation, students' management, school personnel management, management of school plant and facilities, school financial management and management of school-community relations.

In the hypothesis testing, although, there was no significant difference between the managerial effectiveness of male and female principals in FCT senior secondary schools but male principals were rated to be more effective than their female counterparts. On the other hand, the findings of this study support the findings of Yawe (2007) who reported that male principals performed better than their female counterparts in the school management. This study is in line with the study of Matheri, Cheloti and Mulwa (2015), who established that both the male and female principals' were perceived as highly effective. Thomas (2004) stated that research has demonstrated that there are far more similarities than differences in the leadership behaviours of women and men, and that they are equally effective.

Conclusion

School managers (principals) as the leaders of their institutions need to actively initiate practical actions for relevant educational changes and innovations into their managerial functions for effective management and better quality education. The findings of the study have led the researcher to conclude that the principals' gender did not influence their managerial effectiveness in FCT senior secondary schools because both male and female principals were effective in all the six areas of managerial effectiveness under study.

Recommendations

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

1. Government should help to improve the principals' managerial effectiveness in different areas of managerial skills through seminar, workshop and in-service training for better management of senior secondary schools in FCT.

2. Although, the male and female principals were effective in all the six areas of managerial effectiveness under study, they still need further improvement in these areas for better management of the schools.

References

Adesina, S. (1990). *Educational Management*. Ibadan: Fourth Dimension Publishing Co.

Aimee, C. J. (2012). *What is the meaning of managerial effectiveness?* Retrieved from http://www. ehow.com/about_6697806_meaning-managerial effectiveness_.html

Alhourani, L. (2013). *Leadership & effectiveness of University Deans in Lebanon and Egypt: A Study of gender& leadership style.* Capella University.

Balduck, A. & Buelen, M. (2008). *A two level competing values framework to measuring non-profit organizational effectiveness*. Retrieved from http://www.vlerick.com/ en/9638VLK.html

Evoh, C. J. (2007). Policy networks and the transformation of secondary education through ICTs in Africa: The prospects and challenges of the NEPAD e-schools initiative. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT) 3* (1), 64-84. Retrieved from http://ijedict. dec.uwi.edu/include/getdoc.php?id=2198&article=272&mode=pdf

Federal Republic of Nigeria (FRN). (2004). *National policy on education (4th Edition).* Lagos: NERDC.

Hadden, K. (2008). How *principals build capacity.* Retrieved from http://www.teachers. ab.ca

Jenkins, R. (2010). *The four quadrant of administrative effectiveness.* Retrieved from http://m.chroicle.com/article/The-Four-Quadrant-of/123642/

Matheri, E.W.,Cheloti, S.K &Mulwa, D.M. (2015). Principals' gender and management effectiveness in secondary schools: Case of MtitoAndei Division, Kenya. *Journal of Education and Practice,6*(14), 12-17. Retrieved from www.iiste.org

Mehta, M. (2008). *Managerial effectiveness.* Retrieved from www.irma.ac.in/pdf/mdp_cal_pdf/15 .pd f

Nigerian Institute of Management (NIM). (2010). *Developing your management and leadership roles.* Victoria Island, Lagos: NIM

Ogunsaju, S. (2002). Nature and purpose of educational management. In F. Durosaro& S. Ogunsaju (Eds), *The craft of educational management* (pp. 1-14). Ilorin: INDEMAC Print Media.

Ogunshola, F. R. & Adeniyi, A. (2017). Principals' personal variables and information and communication technology utilization in Federal Capital Territory senior

secondary schools, Abuja, Nigeria. *Journal of Education and Practice, 8*(15), 130-37.

Okorie, A. N. (2002). *The comparison of the perception of the school-based and centralized management administrators and teachers toward leadership practices, (Doctoral dissertation).*Baylor University, Waco, Texas.

Oyedeji, N. B., & Fasasi, Y. A. (2006). Dynamics of administrative leadership, In J. B. Babalola, A. O. Ayeni, S. O. Adedeji, A. A. Suleiman and M. O. Arikewuyo (Eds), *Educational management: Thoughts and practice* (pp.175-186). Ibadan: Codat Publications.

Peretomode, V. P. (2001). *Educational administration: Applied concepts and theoretical perspectives.* Lagos: Joja.

Tavakol, M. & Dennick, R. (2011). Making sence of Cronbach's Alpha. *International journal of medical Education, 2*, 53-55

Thomas, D. C., &Inkson, K. (2004). *Cultural intelligence: People Skills for Global Business.* San Francisco: Berret-Koehler.

Udeozor, R. K (2004). *Educational administration: "Perspective and practical implications".* Nimo: Rex Charlse and Patrick Ltd.

Yawe, A. A. (2007). *A comparative study of principals' and teachers' assessment of principals' role performance in Benue State (doctoral dissertation).* University of Abuja, Abuja, Nigeria.

THE ROLE OF PARENTS IN THE TEACHING OF ENGLISH FIRST ADDITIONAL LANGUAGE IN THE INTERMEDIATE PHASE IN LIMPOPO

M Motseke
University of South Africa
motsemj@unisa.ac.za

Abstract

The teaching of English as a First Additional Language (EFAL) in the historically disadvantaged schools in the rural areas of South Africa is a serious challenge for both teachers and parents. The problem is more complex when the teachers are not adequately trained to teach English, and when parents are illiterate or semi-literate. A study was conducted in Ga-Chuene, Limpopo, to determine the extent to which parents were involved in the teaching and learning of English among Grades 4 – 6 learners. The study was qualitative, and semi-structured interviews were used to collect data. A total of 16 parents participated in the study. The parents were purposively selected, since only parents who allowed their children to participate in another study participated in the study. Focus group interviews were used to collect data. Two Focus groups of eight members each were formed. It was found that the involvement of parents in the learning of English by their children was very minimal − mainly due to their illiteracy or lack of knowledge of English. Consequently, the parents' involvement was limited to checking if the children were busy with their books at home − without establishing exactly what the children were doing in terms of the subject, the topic and the instructions. The parents had simply hoped that their children were doing their English homework, and they were doing it correctly. The parents basically depended on the honesty of their children since they (parents) were unable to check and to help their children with their English homework or any school work. It is recommended that parents who can read should be guided on how to monitor their children's work, and teachers should set aside a few minutes to help children of those parents who cannot read and write.

Keywords: rural areas, non-English speakers, disadvantaged learners, parents.

Introduction and background

The use of English as a language of business and communication in many countries, including South Africa, has dramatically increased the importance of English in the world

(Casale & Posel, 2011; Taylor & Von Fintel, 2016).This trend has also popularised the teaching of English in non-English speaking countries. Casale and Posel (2011) in comparing the proficiency in English and income in disadvantaged areas of South Africa, found that those who could read and write well in English, earned higher incomes than those who could not do so. In South Africa, the school legislation does not prescribe English as the language of learning and teaching (LOLT), but the School Governing Bodies of many schools have opted for English as both the First Additional Language (EFAL), and LOLT from grade 4 onwards (de Jager, 2017). The teaching of English to African learners in the rural areas of South Africa is a complex exercise, which is characterised by frustrations and huddles for both teachers and learners. A number of factors may contribute to the difficulty of teaching English in the rural areas. These factors may include the poor training of teachers, inadequate provision of resources, and poor contact with the English language (Alameddine & Mirza, 2016; de Jager, 2017). In addition, English is the second or third language for the majority of teachers and learners (Khokhlova, 2015; Taylor & Von Fintel, 2016). De Jager (2017) states that South African teachers lack the skills in adjusting the curriculum to meet the diverse learning needs of multicultural learners who display multiple intelligences, languages, levels of academic readiness, values, religions, parent education, socioeconomic status, competences and skills. Ismail and Yusof (2016) state that the environment, specifically the conditions in which the learning of the additional language happens, can affect the rate of success in the learning of the additional language. Therefore, if the learners of the additional language are exposed to a rich, nurturing and non-threatening environment, they are most likely to succeed in learning the additional language, while a wanting and ill-equipped environment may make the learning of the additional language extremely difficult. In support of the idea, Smit and Humpert (2012) state that differentiated instruction where the teacher employs various instructional practices that are adapted and applied to diverse and individual learner needs in the classroom contribute to effective teaching and learning. However, African teachers may not be in a position to create a rich and nurturing environment, due to their own challenges with the English language and their poor professional training (De Jager, 2017).

The poor professional training of teachers was a deliberate act of the apartheid government. The quality of education for Africans during the apartheid era was inferior, with the purpose of producing people who could not think critically, and who could not aspire for certain jobs

which were reserved for whites (Christie, 2010; Yamauchi, 2005). In addition, many African children were deliberately denied the opportunity to attend school (Nkabinde,1997). The implications of the poor education system and the low rates of schooling for Africans were high rates of illiteracy, high drop-out rates and academically weak people (Nkabinde,1997). The trend continued for about three decades, thus negatively affecting many Africans over that period. The dawn of democracy in South Africa has not brought about significant improvement to the situation. For instance, despite that basic education (grades 4 to 7) has been constitutionally free and compulsory since 1996 many children of school going age still do not attend school, many poor learners still pay school fees, and serious shortages of resources and facilities are still a serious problem in may schools (Christie, 2010; Kwenda, Ntuli & Gwatidzo, 2015). In addition, the South African education system, since the dawn of democracy, has changed from one paradigm or policy to another: from an Outcomes–Based Education (OBE), through to the Revised Curriculum National Statements (RCNS), to Curriculum National Statements (CNS), and to the current Curriculum Assessment Policy Statement (CAPS) (Christie, 2010; Jansen, 2010). In some of these paradigms, parents were made to contribute ideas into their children's projects, despite their illiteracy or low level of education; while teachers were made to develop teaching and learning materials, despite that their training never prepared them to be curriculum developers and study material writers (Jansen, 2010). The lack of stability has had a negative impact on teaching and learning, since adequate in-service training and orientation for teachers did not accompany each change. The rural areas were the most negatively affected, since they experienced the highest shortages of staff, resources and facilities; as well as inadequate monitoring and support by officials of the Department of Basic Education (Jansen, 2010).

The parents are expected to play an important role in the education of their children. Black & Devereux (2011) state that parents genetically transmit preferences and cognitive abilities to their children, and this process increases the possibility of the children following into the parents' footsteps – which is important if parents are educated or successful. In addition, parents have other ways in which they transmit their socio-economic status (inclusive of educational attainment) to their offspring. For instance, Zahedani, Rezaee, Yazdani, Baghe and Nabeiei (2016) found that the parents' level of education may positively affect the efficiency of the parents' child-rearing activities; while Matsuoka, Nakamuro and Inui (2015) found that college-educated parents tend to employ parenting practices that directly and

indirectly shape their children's learning time and scholastic performance. The involvement of parents in the education of their children was not only found to strengthen relationships between the home and the school, but it was also found to help learners to improve in academic achievement, discipline and active participation in school activities (Fuller, 2010; McNeal, 2014). However, studies reveal that the parents' level of education, income and socio-economic class determine the effectiveness of parental involvement in the education of their children (Black & Devereux, 2011; Kwenda, Ntuli & Gwatidzo, 2015; Matsuoka, Nakamuro & Inui 2015). For instance, educated or middle-class parents generally earn higher salaries, work flexible shifts and possess adequate school/academic knowledge – factors which make it possible for them to invest money in the education of their children and to spend more time helping their children with school work (Black & Devereux, 2011; Kwenda, Ntuli & Gwatidzo, 2015). However, the situation is different when parents are poor and illiterate (or have low levels of education), since they show little interest in the education of their children, or do not believe that they have a role to play in the education of their children (Humble & Dixon, 2017). Porumbu and Necşoi (2013) found that children whose parents are not interested in their schooling are not encouraged to perform well at school. Villiger, Wandeler and Niggli (2014) found that children whose parents worked far away from home (or in other countries) performed academically poorly, left school early and displayed signs of depression due to a lack of parental support. The reason for poor parents' involvement in their children's school matters is that these parents are too obsessed with securing the basics such food, clothes and shelter, and, have little or no time for the education of their children (Humble & Dixon, 2017; Maluleke, 2014). In addition, poor parents, because of their low level of education, think that they know nothing about education matters, and their involvement, therefore, could be a hindrance to the schooling of their children (Maluleke, 2014).

The purpose of this paper is to report on the role parents play in the learning of English as an additional language in a rural school in Limpopo, one of the nine provinces of South Africa. The question to be addressed in this paper is:

What role do parents play in the teaching of EFAL in Limpopo?

Theoretical framework

Social development theory of Vygotsky forms the basis for this study. The major theme of Vygotsky's theoretical framework is that social interaction plays a fundamental role in the development of cognition (Vygotsky, 1978). Vygotsky (1978) states that, "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals." (p57). According to Vygotsky (1978), social development theory involves the process of socialisation, which affects the learning process in an individual: the individual must have an active role in learning for this process to occur faster and more efficiently. This means that when people talk, not only communication takes place, but the internalisation of words uttered also occurs − and this internalisation promotes the development of the cognition and of " the inner speech" (Vygotsky, 1978). The theory is very appropriate for education, since it means that the speaker learns from the listener in the same way as the listener learns from the speaker (reciprocation) (Vygotsky, 1978).

This theory is relevant for this study, since parents may learn from their children, while children may also be expected to learn from their parents. This implies that where parents fail or experience communication problems due to their lack of English knowledge, their children, due to their better knowledge of English and the active role they play in the learning process, may step in to correct or help their parents with the communication process. The complexity of the situation in this study is that the child may know more of the English language than what the adult (parent) knows (unlike in usual scenarios where the adult becomes "the knowledgeable other" (Vygotsky, 1978: 59). Hence the situation where one learns from the other, and where the child has the latitude to step in and lead the learning process, is beneficial for socialisation and interaction. The interaction would not be fruitful if the child played a passive role, since the parent, who has little or no knowledge of English, would dominate the learning process.

Research design

Focus group interviews were used to collect data. Each focus group interview took about an hour. The interviews took place simultaneously, and they were facilitated by two researchers. Notes from the two groups were compared to confirm the trends in the responses of the participants. A total of 16 parents from the rural areas of Limpopo province of South Africa

participated in the study. Two groups of parents, each with eight people, were formed. The parents were labelled using the alphabets, from Parent A to Parent P. The selection of parents was purposive. The following procedure was followed in selecting parents: the parents who completed consent forms for their children (i.e. those who allowed their children to participate in another section of this study), were invited to participate in this study. These parents already knew that a study on English was taking place in the school, thus making it easy to explain the purpose of the parents' study. The participants completed forms to confirm their voluntary participation in this study, and they were informed of the option to withdraw from the study at any stage. All the participants had children in the school, were unemployed and their ages ranged between 30 and 50 years.

Data was collected by means of a set of questions (interview schedule) which was prepared in advance (Winke, 2017). Parents were free to deliberate on the questions, discussing each question among themselves, indicating variations in responding to each question, and coming to some common understanding or response for each question. The researchers asked follow-up questions for the purpose of clarity (Maree, 2013:5; McMillan & Schumacher, 2010). A tape recorder was used, with the permission of the participants (McMillan & Schumacher, 2010).

The descriptive data analysis approach was followed. The data collected was analysed as follows: categories were determined, and words with similar meanings were placed in the same categories (Winke, 2017). From these categories patterns emerged, and the patterns led to themes (McMillan & Schumacher, 2010). The themes were scrutinised in terms of the research question and the purpose of the study (McMillan & Schumacher, 2010). The reason for this approach was to ensure that the purpose of the study is not ignored or forgotten.

Findings and discussion.

The findings were categorised, in line with the views of Carey (2015), who states that the categorisation of questions or responses is important for data analysis. Consequently, the following categories were determined:

- Helping children with homework and school work
- Lack of monitoring
- No English at home
- English reading material

Each category is discussed below.

Helping children with homework and school work: The majority of parents reported that they helped their children with homework and school work. However, their problem was that they were not sure of their own knowledge of English, as to whether it was correct or corresponded to what the teachers said to their children at school. Parent C said: "I try to help, but I do not know if I am right". Parent K said, "I try to help, although I am always corrected by my child". Their children also corrected their parents or opposed their parents' views and, thus, challenged/doubted their parents' knowledge. Those who tried to help, did so with little knowledge and a lot of certainty. This implies that the parents' help did not lead to imparting new knowledge to their children, nor to solving homework problems for their children, but it was more of checking if the work was done or ensuring that the work was done.

The parents who said they did not help their children with homework mentioned that their lack of knowledge of English made it difficult for them to help. Parent L, "I want to help, but I do not know the language"; and Parent A said, "I cannot help". Nevertheless, some of the parents who could not help their children with homework reported that they only asked or checked if their children did the homework. Parent B said, "I just ask the child to show me what she did", and Parent O said, "I look for the date to make sure that they did the homework". Despite that the parents could not establish the correctness of the homework, they did check if it was done or not. The implication is that their lack of English knowledge did not prohibit them from making a positive contribution in the learning of English by their children.

The other issue is that those who helped with homework said they first had to study the part on which the homework was based before they could help or check if the child has done it correctly. Participant L said, "I have to look at other examples in the book before I check my child's homework, and this requires a lot of time". This means that the parent can only check the child's work if it is similar to the one done in class, but cannot help with work that has to be done in preparation for a new lesson, or in a case where learner opinion or independent thinking is required.

Lack of monitoring: Some parents indicated that they ensured that their children adhered to some routine after school: eating, playing, doing homework, watching controlled TV programmes and sleeping at specific times. Parent N said, "I make sure that my child plays for a certain period, then does homework and watches TV before he sleeps". Parent D said, "If I don't check on her, she forgets her work". However, the majority of parents had little control over how children used their time after school. These parents did not bother when their children played, when did they do their homework, how long they watched TV, which TV programmes they watched and when did they sleep. Parent J said, "These children are difficult to control", and Parent H said, "I am also busy with my household chores, and it is not easy to always remember to check the child". The risk of children who are not monitored is that they may not do their homework. Studies have found that children who come to school without having done their homework are many, and this creates tension between the learners and the teachers (Maphosa & Mammen, 2011). In the case of English, this could mean that these children do not do their reading, and thus lack practice in pronunciation, spelling and punctuation. The other risk of children who are not monitored is that they may watch TV programmes that are beyond their age limit, thus negatively affecting their morality and exposing them to foul language – which may not benefit their learning of English.

No English at home: All the participants reported that they themselves could not speak English, except one word here and there. Nevertheless, they encouraged their children to speak English. Parent E said, "I can only speak a simple word but not a sentence in English", and Parent I said, "I am not educated so I cannot speak English". The responses indicate that the parents could not speak English at all. This implies that their children had no one to listen to them when they spoke English, so as to correct them when they made a grammatical or pronunciation mistake. The children were basically on their own on matters related to the speaking and listening of English. The responses also confirm that the level of education of the participants was very low. The low level of education could imply poor involvement of parents in other areas of the children's education – in line with literature, which confirmed that the parents' low level of education corresponds with poor involvement of parents in school matters (Black & Devereux, 2011; Kwenda, Ntuli & Gwatidzo, 2015; Maluleke, 2014).

Lack of English reading material: Most of the parents reported that they had no English reading material such as newspapers, magazines and old storybooks. Parent F said, "We do

not have English books at home", and Parent G said, "I cannot even afford to buy a newspaper or a magazine". The implication is that exposure to English literature at home was minimal or non-existent. The English reading material would play a major role in helping the child to read and speak in English, especially when parents were unable to read and speak English. It should be noted that some households did not have TVs due to the high level of poverty in the area of study. The school would be helpful in providing learners with English reading material. However, most of the schools visited did not have libraries nor classroom corner libraries. This implies that many learners never had the opportunity to access a reading book or reading material printed in English.

The results indicate that the parents were generally keen to support their children in the learning of English, despite the many challenges they faced. The effort of coming to school for the interviews could be a clear indication of the parents' interest in the education of their children, especially the knowledge of English. The participants recognised the fact that their children would have better employment opportunities if they could speak English properly. However, the challenges that many parents faced, such as illiteracy or low levels of education, inability to speak English, and inability to provide their children with English reading material made it difficult for them to effectively help their children with the learning of English. The implication is that teachers did not have adequate support for the learning of English outside the school. Since the school itself has its own shortcomings, such as the lack of libraries, overcrowding and poor teacher training, the teaching and learning of English in the rural areas was a mammoth task, whereby learners depended on their own intelligence, with some help from the teachers and little or no help from parents.

Conclusion and recommendations.

The study focused on the role of parents in helping their children to acquire the knowledge of English in the rural areas of Limpopo, an impoverished province of South Africa. The findings indicate that parents, due to the challenges they face, played a very little role in the learning of English by their children.

The following recommendations can go a long way in helping parents to improve their involvement in the teaching and learning of English:

- Parents to monitor their children's homework, if it was done or not, without establishing its correctness or otherwise;
- Parents to maintain a regular communication with the teachers – so that the performance of the child is discussed, and any deterioration is timeously identified, and
- Parents to monitor the activities of their children after school, so that they are able to ensure that their children make time for school work.

References

Alameddine, M.M. & Mirza, H.S. (2016). Teaching Academic Writing for Advanced Level Grade 10 English. *Procedia - Social and Behavioral Sciences,* 232: 209 – 216.

Black, S. E. & Devereux, P. J. (2011). Recent developments in intergenerational mobility. In O. Ashenfelter, & D. Card (Eds.), Handbook of Labor Economics. Amsterdam: North-Holland.

Carey, M. A. (2015). *Focus Groups. International Encyclopedia of the Social & Behavioral Sciences* (Second Edition) Pages 274–279.

Casale, D. & Posel, D. (2011). English language proficiency and earnings in a developing country: The case of South Africa. *The Journal of Socio-Economics*, 40: 385–393

Christie, P. (2010). The complexity of human rights in global times: The case of the right to education in South Africa. *International Journal of Educational Development,* 30: 3–11

De Jager, T. (2017). Perspectives of teachers on differentiated teaching in multi-cultural South African secondary schools. *Studies in Educational Evaluation*, 53: 115–121.

Fuller, G.O.M.L. (2010). *The benefits of Parental Involvement. What Research has to say.* Allyn Bacon: Prentice.

Humble, S. & Dixon, P. (2017). The effects of schooling, family and poverty on children's attainment, potential and confidence—Evidence from Kinondoni, Dar es Salaam, Tanzania. *International Journal of Educational Research*, 83: 94-106.

Ismail, A. & Yusof, N. (2016). Readability of ESL picture books in Malaysia. Journal of Nusantara Studies, 1(1), 60-70. http://dx.doi.org/10.24200/jonus.vol1iss1pp60-70

Jonathan Jansen, J. (2010). The enduring legacy of OBE. *Times Live*, 22 July.

Khokhlova, I. (2015). Lingua Franca English of South Africa, *Procedia - Social and Behavioral Sciences*, 214: 983 – 991.

Kwenda, P., Ntuli, M. & Gwatidzo, T. (2015). Temporal developments in intergenerational transmission of education: Case for black South Africans. *Research in Social Stratification and Mobility,* 42: 96–113.

Maphosa, C. & Mammen, J. (2011). How chaotic and unmanageable classrooms have become: Insights into prevalent forms of learner indiscipline in South African schools. *Anthropologist*, 13(3), 185 – 193.

Matsuoka R., Nakamuro M. & Inui, T. (2015). Emerging inequality in effort: A longitudinal investigation of parental involvement and early elementary school-aged children's learning time in Japan. *Social Science Research*, 54:159–176.

McMillan, J.H. & Schumacher, S. 2010. (7th ed). *Research in Education. Evidence-Based Inquiry.* Boston: Pearson.

McNeal, R.B. (2014). Parent Involvement, Academic Achievement and the Role of Student Attitudes and Behaviors as Mediators. *Universal Journal of Educational Research.* 2(8): 564-57.

Maluleke, S.G. (2014). Parental involvement in their children's education inThe Vhembe District: Limpopo. *Unpublished MEd dissertation*. UNISA.

Maree, M. 2013(13th ed). *First steps in Research*. Pretoria:Van Schaik Publishers.

Nkabinde, Z. P. (1997). An analysis of educational challenges in the New South Africa. Lanham, Maryland: University Press of America, Inc.

Porumbu, P. & Necşoi, DV. (2013). Relationship between Parental Involvement/Attitude and Children's School Achievements. *Procedia - Social and Behavioral Science*, 76: 706–710.

Smit, R., & Humpert, W. (2012). Differentiated instruction in small schools. Teaching and Teacher Education, 28, 1152–1162.

Taylor, S. & Von Fintel, M. (2016). Estimating the impact of language of instruction in South African primary schools: A fixed effects approach. *Economics of Education Review*, 50: 75–89.

Villiger, C., Wandeler, C. & Niggli, A. (2014). Explaining differences in reading motivation between immigrant and native students: The role of parental involvement. *International Journal of Educational Research*, 64:12–25.

Vygotsky, L.S. (1978). *Mind in Society.* Cambridge, MA: Harvard University Press.

Winke, P. (2017). Using focus groups to investigate study abroad theories and Practice, *System* 71 (2017) 73-83.

Yamauchi, F. (2005). Race, equity, and public schools in post-Apartheid South Africa: Equal opportunity for all kids. *Economics of Education Review*, 24: 213–233.

Zahedani, Z.Z., Rezaee, R., Yazdani, Z., Bagheri, S. & Nabeiei, P. (2016). The influence of parenting style on academic achievement and career path. *Journal of Advances in Medical Education & Professionalism,* 4(3): 130–134.

ASSESSMENT OF FAMILY CHARACTERISTICS AND LEARNERS' VARIABLES IN ENHANCING ACADEMIC ACHIEVEMENT MOTIVATION IN SECONDARY SCHOOLS

Yinusa Akintoye Faremi & Loyiso C. Jita

University of the Free State, Bloemfontein, South Africa

akintoyeyinusa@gmail.com; jitaLC@ufs.ac.za

Abstract

Motivation for academic achievement is a driving force for developing and demonstrating higher abilities for educational attainment. The family characteristics and learners' variables were examined so as to establish the effect and contributions to the learners' academic achievement motivation in secondary schools. The study adopted a quantitative research method of survey design in which 400 secondary school students in Ondo State, Nigeria were selected using a multistage sampling technique. Data were collected using an adapted "Students Academic Achievement Motivation Questionnaire". Statistical tools such as correlation matrix and regression were used to analyse data. The findings of the study revealed that both family characteristics and learners' variables influence learners' academic achievement motivation. The results further reveal that the position and setting in the family have a significant relationship with learners' academic achievement motivation while family setting made the highest contribution. The family structure, family size as well as learners' age and gender had no significant relationship in motivating learners' academic achievement. Based on the findings, it was concluded that the motivation of academic achievement of learners can be mostly influenced by family setting and their position in the family.

Keywords: family structure, family setting, family size, position in the family, age, gender

Introduction

Family and school are the two residences in which learners operate. The family has an impact in determining what the child would be as an adult or the kind of parent in which he/she would be in the future. The school is an environment which has a greater impact on the future

of academic achievement of the learner. This is because the school is where knowledge and skill are built on the child for future development (Animashaun & Aremu, 2015). A family comprises a group of people that are related by marriage and/ or where offsprings are raised. A family is also an integral part of the society which has a lot of functions to perform in the preparation of adolescents for higher education.

The academic achievement of any student can be influenced by the family characteristics and with what they observe within their immediate surroundings. Many people do not consider the family characteristics and the learners' variables as important factors when it comes to motivation towards academic achievement. They only believe that learners can be motivated towards academic achievement by inducing them with materials things such as clothes, shoes and increase in their feeding allowance, providing them with cars and drivers that will take them to school. Thus in most case decisions are taken not because of money but because of social status (Zahedani, Rezaee, Yazdani, Bugheri and Nabeiei, 2016). Some people do not believe that homes that are well structured with a good family setting, sensitivity to the position of the child in the family and a considerable family size can be a positive motivational factor towards academic achievement of the child positively.

In Kenya, literature reveals that more than 25% of homes are headed by the woman as a result of desertion, imprisonment or death of the husband. The Kenyan government has come up with policies that will assist the pupils and students by providing free education whereby the parents will be responsible for providing uniform, pocket money and other necessities that would serve as motivation for the pupils and students in achieving academic success without much rigour. It was revealed that a nuclear family background positively influenced the academic performance of students and provided the motivation needed for students to perform well in their academics while single parenting negatively influenced academic performance of students (Nato, 2016).

In Maharashra State, Indian, literature reveals that academic achievement of adolescent living in highly satisfactory family climate is higher as compared to their counterparts living highly dissatisfactory family climate. It was concluded that family climate has a positive and significant effect on the academic achievement of adolescents (Varma, 2017). In another study conducted in three public sector universities location in Islamabad, Pakistan it was

found that the combination of learners' gender, age, locality, parents' education and income significantly correlated with academic achievement (Nasir, 2012).

Motivation is an inner force that activates and provides direction to our thoughts, feelings and actions. Rabideau (2005) defines motivation as the basic drive for all of our actions. Motivation is also referred to the dynamics of our behaviour, which involves our needs, desire, and ambitions in life. Achievement motivation is based on realising success and achieving all our aspirations in life. Rabideau (2005) identifies two motives that are directly involved in the prediction of behaviour these are implicit and explicit motives. Implicit motives are spontaneous impulses to act, also known as task performances, and aroused through incentives inherent to the task. While explicit motives are expressed through deliberate choices and more often stimulated for extrinsic reasons.

Ogwu, (2018) explains that achievement motivation is a factor that propels someone to succeed in the academic task. It is also a construct that can influence the academic achievement of learners in promoting their preparation for higher education. As such this is where the family setup comes in because it performs a lot of functions by shaping the lives of their children in terms of moral development, identification of their potentials, providing psychological training, the growth and development of their talents and skills, familiarising them with the rules of the environment and guiding them towards societal norms (Zahedani et al., 2016).

Problem statement

Family characteristics and learners' variables are two important factors that need to be considered when determining motivation for learners' academic achievement. Secondary school learners face a lot of challenges in their adolescent age and these challenges require serious attention to surmount. No doubt, family does influence them both positively and negatively. Most of the recent researches focus on the influence of sub-units of each of the family characteristics on academic achievement with limited study in combining each of these units of family characteristics in predicting students' academic achievement motivation in secondary schools. People may also believe that the learners' variables have nothing to do with the academic motivation of secondary school learners. This study seeks to examine the

influence of family characteristics and learners variables on academic achievement motivation in secondary schools.

Purpose of Study

The general purpose of this study is to examine how family characteristics and learners' variables enhance students' academic achievement motivation with a view of guiding their preparation for higher education. The main purpose of this study is to:

1. find out the relationship between family characteristics, learners variable and academic achievement motivation.
2. find out the contribution of each of the family characteristics and learners variables in predicting academic achievement motivation of secondary school students.

Research Questions

1. Is there any relationship between family characteristics, learners' variables and academic achievement motivation in preparing for higher education?
2. Is there any statistical influence of family characteristics and learners' variables on students' academic achievement motivation?
3. What is the relative contribution of each of the family characteristics and learners' variables on students' academic achievement motivation?

Theoretical framework

The study was based on the functionalism theory propounded by George Peter Murdock in 1949 which was modified by Chapman (2017). Functionalism is a structural theory that believes that the social structure of society which made up of a social system such as the economy, family, law, education, median and religion determining social experience and life chances of an individual. The functionalist refers to education as the primary socialisation that occurs within the family. Parents civilise their children by teaching them good manners, respect for others and avoid behaviour and language that might offend other members of the society (Chapman, 2017).

In 1949 George Peter Murdock claimed that nuclear family was universal and existed in every known society. He identifies four essentials functions of family especially nuclear family.

1. Stable satisfaction of the sex drive (monogamous relationship)
2. The biological reproduction of the next generation (without which society cannot continue)
3. Socialization of the young (norms and values)
4. Meeting its members' economic needs (provide food and shelters).
   (Source: ReviseSociology, 2014)

The family equipped its members with the education and skills needed. The family was the main centre of primary socialization in the teaching and learning of the attributes, values behavioural norms and traditions which mainly occurs during childhood and which prepares a child to take their place as an adult in a particular culture or society. Many parents often guide and encourage their children with regards to educational and career choices and provide material and welfare supports well beyond the period of childhood often reciprocate these supports when their parents enter old age (Chapman, 2017). The functionalism was used to underpin this study because the family was the main centre of primary socialization in the teaching and learning through which the culture needs to be transmitted to the next generation through education.

Literature review

Academic achievement motivation

Motivation is the internal feeling that arises from the desires and needs of an individual. It is a continuous process of needs and satisfaction that stimulate the students to perform. It is the process whereby an individual inspires to utilize his/her best capabilities for the achievement of particular goals (Abbas & Khurshid, 2013). Atkinson (1964) cited in Singh (2011) defines achievement motivation as the comparison of performances with others and against certain standard activities. This scholar further asserts that achievement motivation drives towards achieving targets through intrinsic and extrinsic motivation. Intrinsic motivation as driven by

interest or enjoyment in the task itself and exists within the individual rather than relying on any external pressure while extrinsic motivation comes from out of the individual which attracts rewards like money and grades, coercion and threat of punishment (Singh, 2011). Literature reveals that achievement motivation has an important role in achieving a learning outcome. In other words, the higher the achievement motivation of learners, the higher learning achievements gains (Ayundawati, Setyosari, Susilo & Sihkabuden, 2016).

Family characteristics

Sonawat (2001), cited in Sharma (2013) states that family is a unit that is formed by one or more persons through an agreement or who naturally unite together either by marriage, blood, adoption on a consensual union to form a household. Family factors provide a connection to the choice of the students when preparing for higher education in order for the students to be successful in their career. Such factors include family size, family type and family leadership style.

Family Structure comprises of family type or family background which include; monogamy and polygamy (Faremi, 2016). For the purpose of this study, the family structure comprises monogamy and polygamy family. In a study carried out in Pakistan, it was revealed that the effect of family type and size on the academic achievement of students is highly significant (Suleman, Hussain, Akhtar & Khan, 2012).

Family setting refers to biological parents who can be categorized into an intact family, single parent-mother only and single parent-father only. Literature reveals that a family is either broken or intact (Okiemute, 2017). A broken home in this context is one that is not structurally intact for many reasons, which may be death of a parent, divorce, separation and dissertation which many researchers refer to as single parent mother or father. Students from single parents may face some challenges, life can be stressful for such. Such families may likely face diminished financial resources and assumption of new roles and responsibilities (Okiemute, 2017). The learner from a single parent may not be academically motivated as a result of psychological and social problems. Thus, learners coming from stable homes enjoy the resources of both mother and father which influence their academic achievement motivation positively as a result of the effort of the two parents (Okiemute, 2017). Research

reveal that out of other family variables such as family structure and parenting style only family setting has the most significant influence on students' performance in science subjects (Faremi, 2016).

Family size, either large or small remains the primary environment in which the student belongs. Okiemute (2017) maintains that children from small size families perform better at school than their counterparts from other average size and large families. The literature reveals that learner from a smaller family has been linked with higher academic achievement. Also, learners with fewer siblings are likely to receive more parents' attention and would tend to approach and accomplish goals with the purpose of gaining thrill, and excitement (Suleman, et al., 2012). The family setting was recognized as the most important factor that influences students' academic achievement (Suleman, et al., 2012). Another study conducted by Ogwu (2018) reveals that family size is not a good predictor of students' academic achievement motivation.

In the literature, position in the family is referred to as the birth order which is another factor to be considered. The middle child is influenced by the elder child, the second or the middle child usually imitates the first born and he is likely to be what the firstborn is and there is a relationship between birth order and academic achievement (Ositoye, Adeyemi & Onabarniro, 2010). However, in a study carried out by Tenibiaje (2015), it is revealed that the family size and birth order have no influence on the academic performance of pre-degree students in higher institutions. In another study conducted by Chooi (2009) also reveals that there was no significant relationship between an individual's birth order and motivation.

Learners' variables

Age is an important factor that also determines the academic motivation of the learner and mental maturity of an individual is determined by age. Youngsters between the age of 8 and 14 begin to confide less in parents and more in peers and this serves as a great influence on their decision taking (Berndt & Perry, 1986 cited in Animashaun & Aremu, 2015). Wu, Chia, Lee & Lee (1998) cited in Animashaun and Aremu (2015) found out that an increase in the age of students attracted an increase in the rate of delinquency which eventually affects the academic achievement of the students. Some students are motivated through their age

group academically to an extent of choosing the same career as their age group at the higher institutions. Chooi (2009) also highlighted that, the age gap between siblings was significantly related to motivations. The researcher further stated that the larger the age gap between the siblings, the more they are motivated.

Findings of the research conducted by Chetri (2014) reveal no significant difference in achievement motivation with regard to gender. In another research conducted by Amro, Mundy and Kupcynski (2015) found that none of the age and gender could predict the student achievement online course.

Research design

This study adopted survey designs which aligns with a quantitative study where by samples were chosen from the target population in order to generalise or make an inference on the population from where the samples were drawn.

Population and sample

The population for the study comprised all secondary school students, while the target population was the senior secondary school student in Ondo State, Nigeria. Four hundred (400) senior secondary students (SSS2) were selected using a multistage sampling technique. The state has already been divided into three senatorial districts in which two local governments were selected per district and two secondary schools per local government using simple random technique. The four hundred (400) learners were selected from the twelve schools using proportional stratified sampling technique. The reason for using SSS2 students for this study is that they are the set of students who are preparing for joint promotional examination to the final class in preparation for higher education.

Research instrument

This study adapted a research instrument titled "Students' Academic Achievement Motivation Questionnaire' of four point Likert scale from strongly disagree=1, disagree=2, agree=3 and strongly agree =4 that contained 25 items on academic achievement motivation with other information pertinent to the students' variables and family characteristics. This instrument was developed by Aremu and Hammed (2002) from the University of Ibadan, Nigeria.

Validity and reliability

The validity of the instrument was determined using face and content validity in which some items were modified. The new version of the questionnaires was administered on 20 selected senior secondary students who were not part of the sample for the study. Data collected were subjected to Cronbach Alpha with a reliability coefficient value of .71 which shows that the instrument's consistency in measuring what it was designed to measure.

Administration of instrument

The questionnaire was administered with the help of trained student teachers from Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria who were posted to various schools during teaching practice exercise in Ondo State secondary schools. This was done under the supervision of the various heads of the department in the schools selected for the study. The questionnaire was given to students with instruction to complete during the school hours and collected after school hours.

Data analysis

Data collected were analysed using descriptive and inferential statistics. The research questions raised were answered using inferential statistics such as correlation matrix and regression analysis in which the descriptive statistics served as a basis for the inferential statistics used for the analysis.

Research Question one: Is there any relationship between family characteristics, learners' variables and academic achievement motivation in preparing for higher education?

Results

Table 1: Correlation matrix analysis of family characteristics, learners' variables and academic achievement motivation

	Age	Gender	FS1	FS2	FS3	PF	AAM
Age	1						
Gender	-.026	1					
FS1	.023	.065	1				

FS2	-.083	.078	-.070	1			
FS3	.010	.040	.133**	-.018	1		
PF	-.021	.059	.114*	.020	.071	1	
AAM	-.015	.052	-.035	.175**	.068	.118*	1

**correlation is significant at 0.01 level, *correlation is significant at 0.05 level

Family structure=FS1, Family setting=FS2, Family size=FS3, Position in the family=PF, Academic achievement motivation=AAM

Table 1 shows the relationship between family characteristics, learners' variables and students' academic achievement motivation. Two out of the independent variables that are the family setting (r=.175, P<.01) and position in the family (r=.118, P<.05) have significant positive relationships in enhancing students' academic achievement motivation at 0.01 and 0.05 level of significance. Family structure, family size, Age and gender have no significant relationship in enhancing students' academic achievement motivation in preparation for higher education.

Research question two: Is there any statistical influence of family characteristics and learners variables on students' academic achievement motivation?

Table 2: Regression analysis of the combined independent variables

Model	SS	DF	MS	F	Sig	R	R^2	Adjusted R^2
Regression	1529.809	6	254.968	3.515	.002	.226	.051	.036
Residual	28509.551	393	72.543					
Total	30039.360	399						

a. Predictor: (constant), age, gender, family structure, family setting, family size, and position in the family

b. Dependent variable: Academic achievement motivation

Table 2 displays the result of the multiple regressions. The analysis shows that the independent variables combined significantly to influence students' academic achievement motivation ($F_{(6, 393)}=3.515$, P<.05). The R-value of .226 shows the correlations between the independent variables and the dependent variable. The R square value of .051 represented by 5.1% tells us how much variance in the dependent variable is accounted for by the predictors as indicated in table 2. The adjusted R square value of .036 represents 3.6% of the variance in the dependent variable accounted for by the predictors generalises in terms of the population

rather than the sample. The remaining variance could be attributed to other variables not included in this model.

Research question three: What is the relative contribution of each of the family characteristics and learners' variables on students' academic achievement motivation?

Table 3: Regression coefficient of the effect and contribution of each of the independent variables

	Unstandardized		Standardized		
Model	B	Std. Error	Beta	t	sig
Constant	60.706	3.443		17.631	.000
Age	-.002	.080	-.001	-.026	.980
Gender	.582	.901	.032	.646	.518
Family structure	-.852	.904	-.047	-.942	.347
Family setting	2.983	.879	.168	3.395	.001
Family size	1.193	.871	.068	1.369	.172
Position in the family	1.257	.549	.114	2.290	.023

The regression coefficients in table 3 reveal that an increase or decrease in the independent variable by one unit would result in a significant change in students' academic motivation. The beta weight of the six independent variables is given in table 3 with a constant of 60.706. The family setting out of the family characteristics has the strongest positive effect on students' academic achievement motivation (Beta=.168, t=3.395, P <.05) and it also makes the most significant relative contribution to the prediction of students' academic achievement motivation in which there is a significant change in students' academic achievement motivation by 2.983. The second strongest positive effect on students' academic achievement is position in the family (Beta=.114, t=2.290, P<.05) in which case there is a significant change in students' academic achievement by 1.257. Other variables in the study such as age (Beta=-.001,t=-.026, P>.05), gender (Beta=.032, t=.646, P>.05), family structure (Beta=-.047, t=-.942, P>.05) and family size (Beta=.068, t=1.369, P>.05) have the weakest effect and contribute less to the students' academic achievement motivation.

Discussion of findings

The family setting and position in the family out of the four family characteristics used in this study have a significant relationship in enhancing students' academic achievement motivation in preparation for higher education. Both the family setting and the position in the family make relatively significant contributions to the students' academic achievement motivation. The findings of the study support the outcome of a study carried out by Faremi (2016) that family setting has the most significant influence on the achievement of students in science subjects. The study further confirms the findings of Okiemute (2017) that students from intact homes enjoy the resources of both mother and father which boost their academic achievement motivation as a result of the efforts put together by the parents. Ositoye et al. (2010) confirm that there is a relationship between birth order and academic achievement which is in agreement with this study.

The family variables such as family structure and family size are not significantly influenced by students' academic achievement motivation. Findings of Suleman et al. (2012) reveal that there is a highly significant effect of family type and size on the academic achievement of learners which is not in conformity with the outcome of this study.

The two learners' variables used in this study such as age and gender do not significantly influence students' academic achievement motivation which support the finding of Amro, Mundy and Kupcynski (2015) that age and gender could not predict the student academic achievement. The family size contributes little towards motivation of academic achievement while family structure contributes negatively to students' academic achievement motivation. This finding contradicts with the finding of Chooi (2009) which states that age gap between siblings is significantly related and the larger the age gap between siblings, the more they are motivated towards their academic performance.

Conclusion

Based on the findings of this study, it is evident that the family setting and position in the family significantly influence students' academic achievement motivation. The two variables also contribute to the prediction of students' academic achievement motivation, but the family setting has the strongest predictive power than the position in the family. The findings of the study further illuminate that an intact family would effectively influence the academic

achievement motivation of learners. In most cases, people believe that firstborn child from an intact family always serve as a role model to younger siblings in the family because of the influence of parents.

Recommendations

The following recommendations are made:

1. Parents should guide against a broken home, especially divorce between husband and wife so that students can be properly guided on their academic career through proper monitoring.
2. The firstborn or the eldest must be properly guided in order not to mislead the younger siblings so that they could be positively motivated towards their academic achievement.

References

Abbas M. & Khurshid, F. (2013). Motivational techniques and learners' academic achievement at primary level. *Global Journal of Human Social Science Linguistics and Education 13* (3). Retrieved from globaljournals.org/GJHSS-volume13/2-motivational-techniques-and-learners-pdf.

Amro, H. J., Mundy, M. A. & Kupcynski, L. (2015). The effects of age and gender on students achievement in face-to-face and online college algebra classes. *Research in Higher Education Journal, 27*, 1-22.

Animasahun, R. A. & Aremu, C. A. (2015). Correlational study of age, family warmth and school connectedness as factors affecting juvenile delinquency among secondary school adolescents in Osun State, Nigeria. *International Journal of Psychology and Behavioural Science, 5*(2), 80-88.

Aremu, O. & Hammed, A. (2002). *Ibadan multi-dynamic inventories of achievement motivation.* Ibadan: University of Ibadan Press.

Ayundawati, D., Setyosari, P. and Susilo, H. Sihkabuden, S. (2016). Influence of strategy of learning and achievement motivation of learning achievement class VIII students of state junior high school in district Blitar. *Journal of Education and Practice. 7* (32), 109-112.

Chapman, S. (2017). Functionalism and the family sociology stuff. Retrieved from http://www.sociologystuff.com/ download/ baoa5deb-b83b-11e7-8489-b186615473aa.

Chetri, S. (2014). Self-concept and achievement motivation of adolescents and their relationship with academic achievement. *International Journal of Advancements in Research and Technology, 3*(5), 236-253.

Chooi, W.T (2009). *Birth order and motivation*. An unpublished M.Ed Dissertation Western University, Richmont, London. Retrieved from .http://eld.Ohiolinle. edu/rws. etd/document/go//case1244143069/inline.

Faremi, Y. A. (2016). Family variables as predictors of secondary school students' academic achievement in core science subjects. *Nigeria Journal of Educational Research and Evaluation, 15*(1), 239-250.

Nasir, M. (2012). Demographic characteristics as correlates of academic achievement of university students. *Academic Research International, 2*(2), 400-405.

Nato, P. B. (2016) Analysis of family structure influence on academic performance among secondary school students in Bungoma East Sub-county, Kenya. *International Journal of Secondary Education 4* (2), 12-22.

Ogwu, A.V. (2018). Family factors as predictors of academic achievement motivation among secondary school students in North Central Zone of Nigeria. *International Journal of Education and Research, 6* (2) 157-170.

Okiemute, E. (2017). Influence of parental background on secondary school students' academic achievement. *International Journal of Advance Research and Innovative Ideas in Education 3* (1), 123-129.

Ositoye, A., Adeyemi, M. and Onabarniro, A. (2010) Influence and relationship of birth order and secondary school students' academic achievement. *Academic Leadership: The Online Journal, 8* (4). Retrieved from https://scholars.fhsu .edu/cgi/viewcontent. cgi?article=1537&context=alj.

Rabideau, S. T. (2005). Effects of motivation on behaviour. *SAPA Project Test*. Retrieved from http://www.personalityresearch.org/papers/rabideau.html.

ReviseSociology (2014). *Functionalist perspective on the family*. Retrieved from https//revisesciology.com/2014/02/09/functionalist-perspective family.

Sharma, R. (2013). The family and family structures classification redefined for the Current Times. *Journal of Family Medicine and Primary Care, 2* (4) 306-310.

Singh, K. (2011) Study of achievement motivation in relation to academic achievement of students. *International Journal of Education Planning &* Administration*, 1* (2) 161-171.

Suleman, Q., Hussain, I., Akhtar, Z. and Khan, W. (2012). Effect of family structure on the academic achievements of students at elementary level in Karak district; Pakistan. Journal of Sociological Research, 3(2) 234-247.

Tenibiaje, D. J. (2009). Influence of family size and birth order on academic performance of adolescents in higher institution. *Pakistan Journal of Social Science, 6* (3), 110-114.

Varma, P. J. (2017). Effect of family climate and parental encouragement on academic achievement of school going adolescent. *International Journal of Indian Psychology, 4*(4), 1-17.

Zahedani, Z. Z., Rezaee, R., Yazdani, Z., Bagheri, S. and Nabeiei, P. (2016). The influence of parenting style on academic achievement and career path. *Journal of Advances in Medical Education and Professionalism 4* (3) 130-134.

COGNITIVE ORGANISATION OF THE GRADE 10 LIFE SCIENCES CONTENT TO CREATE A MEANINGFUL LEARNING: EXPLORING VIEWS OF THE BOJANALA EAST TEACHERS (NORTH WEST PROVINCE)

FM Teane
University of South Africa

teanef@unisa.ac.za

Abstract

The paper explores Bojanala District (North West Province) teachers' views regarding the cognitive organisation of the Grade 10 Curriculum Assessment Policy Statement (CAPS) Life Sciences content which according to CAPS there must be knowledge progression and coherence of facts. Cognitive organisation of content refers to the arrangement of content in such a way that it fits the specific age group and new topics are relatable to a previously learned background of meaningful ideas and information. Such an organisation of content is essential because the learner already knows the most important factors influencing learning and how the learning content is structured to enhance teaching and learning the subject. The research was informed by the general outcry about the difficult Life Sciences Grade 10 content and the researcher is exploring whether the content is organised in a way to suit the intended Grade. A qualitative research approach was used and since the paper focuses on a particular group of people (Life Sciences teachers), A case study became relevant to this study. The sample of Grade 10 Life Sciences teachers were purposefully selected. Data was collected through one-on-one and focus groups interviews. Ausubel's meaningful learning theory was used as a lens to inform the findings of the study. The findings of the study indicated that the organisation of Grade 10 Life Sciences content does not suit the cognitive structure of the envisaged learner. Therefore, the researcher recommends that there be a cognitive organisation of content to provide for meaningful learning.

Keywords: CAPS, Further Education and Training Band (FET), General Education and Training Band (GET), Grade 10 content, Life Sciences, Meaningful learning, Subsumption theory, Teachers

INTRODUCTION

The sporadic changes in the subject Life Sciences impacted on the teaching and learning of the subject especially changes in the Grade 10 content. While change is inevitable, the policy changes in the South African context became a common focal point to ease the pressures experienced by the national government (Nicholl, Flutter, Hosking & Clarkson 2013). The African National Congress (ANC) government experienced the pressure of having to eradicate the legacies bred by the apartheid regime; and as a remedy, a plethora of policies were issued in a short space of time (Hoadley & Jansen 2009). The Life Sciences subject experienced four policy changes between 1996 and 2012 and the study focuses on the last policy change called CAPS. The subject, Life Sciences, was affected by the sporadic policy changes in that some topics were shifted from one Grade to another. During the development of CAPS curricula, the policy statement suggested the application of the principle of progression which implies that selecting content shows the progression from simple to complex and that there should be the coherence of facts in the content (DBE 2011). In progression, there is a purposeful sequencing of teaching and learning expectations across multiple developmental stages, ages or grade levels. The focus of the paper is on the content of Grade 10 Life Sciences where the researcher explores whether the content was organised to suit learners of the Grade and also to check whether there is the coherence of facts in the Life Sciences content. the quest for this research was motivated by earlier research done by De Villiers (2011), with the finding that Grade 10 Life Sciences content is difficult and it prevented the learners from achieving the vertical development of disciplinary knowledge. In her personal experience as a Life Sciences subject advisor, the researcher agrees with De Villiers (2011)' findings to a certain extent because, according to the researcher, performance in Grade 10 was very poor since the inception of CAPS. The study is an extension of de Villiers (2011)'s findings in the sense that the researcher tries to locate the cause of difficulty of the content by analysing the organisation of the content of Grade 10 Life Sciences. More focus will be on whether the selected content matches the envisaged age group and whether topics are arranged in such a way that a connection between them is outlined as the coherence of facts in the CAPS policy. The CAPS document states that when teaching Life Sciences, teachers must help learners recognise the links between related topics and that the links must be made across the grades (DBE 2011), which means that in progression there must be some connection between what the learners learned in GET (especially Grade 9 syllabus) with what they will be learning in FET Grade 10 and within the content of Grade 10. This means that

the new content which is to be learned in Grade 10 must build on knowledge and skills acquired from the Life Sciences knowledge areas in GET. Based on the above assumptions, the researcher wished to explore teachers' views on the cognitive organisation of the Grade 10 CAPs content. The researcher made preliminary findings of the study, using document analysis whereby FET Grade 10 CAPS and GET Grade 9 syllabi were scrutinised to search for traces of knowledge progression and coherence of facts.

Table 1 below provides information on the selected topics for Grade 9 Live and Living and Grade 10 Life sciences syllabi and how they are sequenced.

Period	Grade 9	Period	Grade 10
2 weeks (Term 1)	Cells as the basic unit of life (cell structure	2½ weeks (Term 1)	Organic and inorganic compounds (water, carbohydrates, lipids, proteins, vitamins, nucleic acids)
2 weeks (Term 1)	Systems in the human body Digestive, circulatory, respiratory, musculo-skeletal, nervous Reproductive	3 weeks 2 weeks (Term 1)	Cells – basic units of life Cell division
2 weeks (Term 1)	Human reproduction (purpose and puberty, reproductive organs, stages of reproduction)	1 week (Term 1) Term Test Practical 2 weeks (Term 2)	Plant and animal tissues Plant and animal tissues
		3 weeks (Term 2)	Support and transport systems in plants (anatomy of dicot plants, transpiration)
1½ weeks (Term 1)	Circulatory and respiratory systems (breathing, gaseous exchange circulation and respiration)	weeks (Term 2) Term Test Practical	Support and transport in animals (human skeleton)
1 ½ weeks (Term 1)	Digestive system (healthy diet, the alimentary canal and digestion)	3 weeks (Term 3)	Transport systems in mammals (human circulatory system – heart and lymph)
		6 weeks (Term 3) Term Test Practical	Environmental studies (biosphere to ecosystems, biotic and abiotic factors)

		1 week (Term 4)	Biodiversity and classification (bacteria, protista, fungi, plants, and animals)
		5 weeks (Term 4) Term Test Practical	History of life (geological time scale, Cambrian explosion, mass extinction, and fossil formation)

According to Table 1, in Grade 10, after each term, there is an administration of a term test and a practical work which serves as term mark and an assessment based on content taught in a specific term. A teacher is therefore forced to teach content in the chronology indicated in these terms to be able to administer a test which covers the content of the whole term.

As far as the Grade 9 Life and Living content is concerned, Table 1 indicated that the topic of environmental studies does not form part of the Grade 9 syllabus. the topic appears in Grade 10.

There is no link between Grade 9 and 10 in the topic Organs and Systems. Many systems are taught in Grade 9, and in Grade 10 there is a topic on Tissues and Organs which must precede the topic on Systems.

There are no topics on Biodiversity and Classification and the History of Life (Evolution) in Grade 9. It only starts in Grade 10 and therefore has no foundation from Grade 9. The topic Evolution is new and only starts in Grade 10 with no link from the GET. Narrativity is lacking between the first topics Organic and Inorganic Compounds and Cells in the content of Grade 10. Some topics in Grade 10 were once taught in Grade 12, namely Organic and Inorganic Compounds and Transpiration.

RESEARCH QUESTIONS

Does the organisation of the Life Sciences CAPS Grade 10 content match the cognitive structure of the envisaged group?

Sub-questions

- Is there a link between GET Grade 9 topics and FET Grade 10 topics?
- Is there coherence of facts between topics of Grade 10 content to provide meaningful learning?

THEORETICAL FRAMEWORK

The study is about the cognitive organisation of content to create meaningful learning of the Life Sciences subject content. It is therefore underpinned by Ausubel's subsumption theory which is a theory about the facilitation of meaningful learning and retention of content (1962). According to Ausubel (1962), in human beings, learning takes place through a meaningful process of new events or items that are related to existing cognitive concepts. Ausubel (1962) also refers to this as new items hanging on existing cognitive pegs where the new material is anchored on already established entities in the cognitive structure. When such a cognitive structure exists in the human mind, the new material becomes appropriately subsumed under a more inclusive conceptual system.

Meaningful learning in the teaching and learning situation becomes possible if the learners can relate to the new information to what they have, which Ausubel (1962) calls the cognitive structure of knowledge. Sweller (1994) posited that learning becomes easy when there are schemas which promote long-term memory storage and reduce working memory limitations. According to Ausubel (1980), "new ideas and information are learned and retained most efficiently when inclusive and specifically relevant ideas are already available in cognitive structure to play a subsuming role or to furnish ideational anchorage". It means that human beings approach any new problem with an existing set of cognitive structures (Brown 1972). The cognitive structure provides anchorage for the new material and allows a stable way of retaining it for future availability. When learners have what Ausubel (1980) calls anchoring ideas, which consist of prior experiences and cognitive structure, they can interact with new material with understanding. Brown (1972) refers to the situation whereby prior knowledge benefits the learning task as a positive transfer. The opposite happens (negative transfer) when the previous performance disrupts the performance of a second task referred to as interference.

According to Ausubel (1962), the inability to relate the new content to the existing schema leads to rote learning. Rote learning refers to the process of acquiring material as discrete and relatively isolated entities that are relatable to cognitive structure only in an arbitrary and verbatim fashion and does not permit the establishment of (meaningful) relationships (Ausubel 1968). Therefore, with rote learning stored items become isolated blocks with no function in building a structure and no relationship to other blocks. It is very easy to forget such information because with time the specific items become progressively less identifiable as entities in their own right; they are finally not available and are said to be forgotten. To prevent forgetfulness in terms of being able to retrieve the stored information, Brown (1972) prefers 'pruning' which is the elimination of unnecessary clutter of material in the cognitive system and the ability to store material as a single whole without clearly defined parts.

Conversely, a meaningfully learned subsumed item has the best potential for retention. A learning situation becomes meaningful if leaners have a meaningful learning set; that is, a disposition to relate the new learning task to what they already know, and the learning task itself is relatable to the learner's structure of knowledge. If learning was meaningful, leaners can easily remember learning material when the need arises.

Ausubel's subsumption theory has educational implications for the development of the Life Sciences subject content because it emphasises the importance of developing a learning structure where there is a close link between adjacent topics to provide a background which leads to meaningful learning. Topics that appear first in the Life Sciences syllabi must provide a cognitive structure for mastering topics that follow suit. A lack of coherence of facts in the Life Sciences content leads to the negative transfer of concepts, and the learners' lack of understanding gives them no option but to resort to rote learning. Learning by rote content is easily forgotten and cannot be applied in the assessment tasks.

LITERATURE REVIEW

The coherence of facts as a tool for effective teaching and learning

The coherence of facts refers to sensible connections and coordination between the topics that students study in each subject in a grade and as they advance through the grades (Newmann, Smith, Allenswork & Bryk 2001). According to these authors, there should be some form of

relatedness between adjacent topics. Roseman, Stern, and Koppal (2010) further posit that coherence means that the curriculum material must present a set of age-appropriate scientific ideas and connections among them. According to Roseman, Stern, and Koppal (2010), the material must aim at "stitching the unknown ideas to the known as it moves from one level to the next". The advantage of having a coherent content in and between the grades is that it helps students to incorporate new understanding into prior knowledge (Newmann; Smith; Allenswork, & Bryk 2001). Such a practice promotes meaningful learning and motivation to learn. Unlike incoherence which reduces student engagement in the hard work that learning often requires, coherent instruction develops competence in the students since can then achieve competence and the mastery of content, because, according to research on learning and cognition, students of all ages are more likely to learn when their experiences connect with and build on one another (Greeno, Collins & Resnick 1996). Thus, when there is little connection between past, present and future reading activities, it is more difficult for students to process the information. Fisher; Wandersee and Moody (2000) refer to organising content to indicate connections between topics as mapping the biology content which helped them to see if the ideas hang together

METHODOLOGY

This study is based on the interpretivism and constructivism research philosophy which, according to Kipo (2013), are multiple realities or truths based on an investigator's construction of reality. This study is interpretive because it is guided by a set of beliefs and feelings about the world and how it should be understood and studied (Denzin & Lincoln 2013). The research sought information about the cognitive organisation of Grade 10 Life Sciences content. By providing a set of complex interpretive practices (using more than one methodological practice), the researcher will construct knowledge through lived experience and through his interaction with other members of the society (Denzin & Lincoln 2013). A qualitative research design was used in this research, which focuses on the perspectives and experiences of participants and utilised tacit, intuitive and felt knowledge (Creswell 2009). Since the aim of the study was to discern how Life Sciences teachers view the cognitive organisation of Grade 10 Life Sciences content, a case study became the best approach for this research because its main aim is to provide an in-depth description of a small number of cases (Mouton 2003).

Sample

The population of the study comprised Life Sciences teachers (about 300) in the Bojanala District in the Northwest Province. Most schools in the district are in rural areas and out of the 96 schools that have Life Sciences as one of their subjects only about 35 are former model C schools with facilities to provide a conducive teaching and learning environment. In this study, a sample of 33 Life Sciences teachers who have been teaching the subject for a period of 22 and 30 years and are aged between 40 and 55 was purposefully selected. Out of the 33 participants, 19 were females and 14 males because only participants who were willing to participate in the study were used.

The researcher applied the ethical clearance process of informed consent and privacy and confidentiality. The participants were informed about the nature and consequences of the research, and their confidentiality was assured as the primary safeguard against unwanted exposure (Denzin and Lincoln 2013.

Data collection strategies

Two focus groups and one-on-one interviews with 20 participants were used to collect data. A semi-structured interview strategy was used in the face to face one-on-one interview and in the two focus group interviews because this technique allows the researcher to ask probing questions to explore what participants have to say in more detail (Jensen & Laurie 2016, Hoets 2012).

Data analysis

The researcher engaged in the thematic analysis of data, using the Saldana method of qualitative analysis. Firstly, data were broken down into codes. Saldana (2016) describes coding as the "critical link" between data collection and their explanation of the meaning. Coding was thus done through the identification of patterns which demonstrated habits, salience and their importance in people's daily lives. Data were then categorised by grouping, reorganising and linking the codes to consolidate meaning. Finally, themes emerged from such categories and were used to discuss the findings of this research.

FINDINGS

Lack of continuity

The participants indicated that the organisation of Grade 10 Life Sciences content is in such a way that there is no proper link between the Grade and the preceding Grade 9. One participant (A) said: *The problem is in GET there is no enough foundation. Most of the topics in Grade 10 are new and have no link in Grade 9. In CAPS the Grade 7 syllabus is the one that links with the Grade 10 syllabus.* This means that some topics in Grade 10 have no proper background from Grade 9; therefore, such topics might be difficult to learn. One participant (B) stated the problem as follows: *Learners have no foundation of the topic environmental studies, it starts in Grade 10 and has got many terminologies which a learner must master.*

Participants also indicated that the problem is not only about new topics that start in Grade 10, but also about introducing very difficult topics like Evolution which the participants did not like. Participant C stated the following in this regard: *The teaching of the topic of evolution is challenging and it is taught in Grade 10 and 12 only. Grade 10 learners have no foundation of the topic.*

The findings also indicated that the allocation of topics between Grades 9 and 10 resulted in confusion in the sense that the content which, according to CAPS principle of progression, must start from the simple to the complex was vice versa; that is, Systems are taught in Grade 9 in Grade 10 there are topics on Cells and Organs which must precede Systems. Participant D said: *In Grade 9 learners are taught about many systems then when they transit to Grade 10 they are then taught cells and organs which must be taught first before systems. Learners become confused and are unable to store information easily.*

A lack of continuity and knowledge progression is also noticeable in the first two topics in Grade 10. The first topic in Grade 10 Organic and Inorganic Content does not link with the second topic Cells. Participants indicated that learners are unable to use the first topic as a background to understand Cells. Participant E stated the following: *I have realised that learners have a problem of mastering the structure of the fat molecule and amino acid, they hate the structural formula of the organic compounds and this affects their mastery of the second topic (cells).*

Abstract content

The findings further indicated that a plethora of policy changes, specifically for the subject Life Sciences, has led to the shifting of topics from one Grade to the another. Some topics which were previously taught in Grade 12 were shifted to Grade 10 and this made the Grade 10 content very difficult to teach. Participant F said the following in this regard: *Grade 10 syllabus is not easy to teach. The topics are difficult. Some topics were previously taught in grade 12 e.g organic and inorganic compounds, Transpiration and Guttation*. The situation was exacerbated by too many topics with limited time allocation, and it became a nightmare to master the Grade 10 content because of the language barrier. One participant (G) made the following statement in this regard: *There is too much content with little time allocation. The language barrier also makes the teaching and learning of the subject difficult.*

Poor performance

The participants indicated that because of the poor cognitive organisation of the Life Sciences content, the general performance of Grade 10 learners is very poor. Owing to too many topics that must be mastered in a very short space of time and because of the English second language barrier, Grade 10 learners are unable to engage in self-study and this affects their performance in the subject. Participant H said the following: *Grade 10 learners cannot cope because they have a problem of remembering. The topics are difficult and the learners cannot read with understanding. Most of the general stream learners (learners doing History, Geography and Maths Literacy) are performing very bad. Only the science group are trying to do better.*

or. The poor organisation of the content encouraged rote learning. It became impossible to memorise every bit of the Grade 10 content; hence, poor performance. Participant, I made the following statement*: Learners adopt rote learning as a learning strategy because they do not understand some of the topics. During the exams, they can't remember most of the memorised content and they fail in a big number*

DISCUSSION

Findings of the research added to de Villiers' (2011) findings that the Grade 10 content is difficult. One of the reasons for the high level of difficulty emerged from this research as lack of a link between Grade 9 and Grade 10 syllabi which prevented learners from acquiring

what Ausubel (1962) called meaningful learning. Meaningful learning of the Grade 10 content is compromised because from the participants' point of view, topics such as Evolution and Environmental Studies which emerged in Grade 10 and have no background from Grade 9 made understanding of the content very difficult because learners have no anchoring ideas (Ausubel 1962) hence are unable to relate the new information to their cognitive structure of knowledge. The anchoring ideas Sweller (1994) refer to as schemas lead to automatic processing of information and facilitate learning. For a Grade 10 Life Sciences learner, mastering the topics mentioned above will be problematic because the Grade 9 syllabus does not provide a background knowledge to facilitate learning of the new topics. Thus a Grade 10 teacher must first provide a background knowledge of the new topics something which will consume much of the teaching time, hence participants indicated that they are unable to finish the syllabus. Due to difficult topics which according to Ausubel (1962) are caused by lack of schemas, Grade 10 learners are unable to engage in self-directed learning, because the learning structure does not provide support; that is, sequencing content in such a way that new materials are easily subsumed under a more inclusive conceptual system (Ausubel 1968).

Apart from the lack of a link between the Grade 9 and Grade 10 syllabi, participants indicated that the Grade 10 topics are many and according to them do not suit the age group. As indicated in Table 1 there are tight schedules for completion of the prescribed content for Grade 10. Teachers are, therefore, unable to do remedial work for students who are not performing well because of time constraints. Many topics where some of the topics lack the background knowledge make the Grade 10 content not to fit the cognitive structure of the envisaged age group. The many topics will result in cognitive overload (Sweller 1994) where the children' working memory will be forced to absorb more than it can accommodate. The situation is exacerbated by the fact that there is no cognitive structure that allows easy subsumption of the new material.

The findings also indicated that in the selection of Grade 10 content, CAPS principle of knowledge progression was not totally applied since the participants indicated that some topics were once taught in Grade 12 namely Organic Compounds and Transpiration. According to Roseman, Stern and Koppal (2010) curriculum material must present a set of age-appropriate scientific ideas and connections among them (2010). The level of difficulty

of such topics coupled with the learners' lack of relevant schemas to deal with such a content may encourage them to passively consume teacher-delivered lessons because they lack the metacognitive skills needed to practice independent learning (Fisher, Hafner& Young 2007). Gibbons (2015) encourages a teaching and learning environment in which the teachers and learners are regarded as active participants and learning is regarded as a collaborative endeavour. In this case, the Grade 10 learners will not be actively involved since some of the topics are above their cognitive structure. Introducing topics which were once taught in Grade 12 in the Grade 10 syllabus counteracts what Piaget (1983b) said about cognitive development because Piaget's theory encourages policy developers and teachers to provide learning material which fits the cognitive development of that specific age. According to Roseman, Stern, and Koppal (2010), if learners are presented with learning material that is not age-appropriate they will not engage in meaningful learning because the material does not match their cognitive structure.

The participants also indicated that there is a lack of coherence between the Grade 10 Life Sciences content in the first two topics namely Organic Compounds and Cells. Fisher, Wandersee and Moody (2000) encourage mapping of the Life Sciences content whereby the selected content must not only fit the envisaged age group but also link with other selected topics so that there is coordination between the topics that students study in each subject in a grade as they advance through the grades (Newmann, Smith, Allenswork & Bryk 2001). According to Roseman et al (2010: 53), the coherence of facts is needed for "stitching the unknown ideas to the known as it moves from one level to the next". The absence of coherence of facts makes learners acquire material as discrete and relatively isolated entities which Ausubel (1968) refer to as rote learning. In rote learning, schemas are not used to store information; therefore, retaining such material in the long- term memory becomes a mirage. The reason why learners are forgetful, according to participants, is that it will be difficult to remember material which was rotely learned

Participants' assertions that learners are unable to cope is due to the fact that the organisation of Life sciences material does not fit the cognitive structure of the specified Grade. Too many topics which according to de Villiers (2011) were more difficult than Grade 12 topics proves that the cognitive development of the target audience was not taken into consideration during the selection of the Life Sciences learning material for Grade 10 learners. The participants

indicated that performance in the subject was very poor because what these learners were expected to study could not fit into their cognitive structure to create schemas for future use if the need arises. Findings of this research indicated the importance of structuring content according to the cognitive structure of the envisaged group something which caution policy developers to consider the cognitive development of learners when they assign topics to be learned. The study was done in part of the North West Province, therefore, findings from this study cannot be generalised. There is a need to do the same study in other Provinces to increase the credibility and trustworthiness of the data collected.

CONCLUSION

In this paper, the researcher discussed issues which convincingly led to the conclusion that in the selection of topics for the Grade 10 Life Sciences learners the cognitive development of the envisaged age group was not taken into consideration.

The following recommendations are thus made:

- Policy designers should select teaching material which suits the age group
- The number of Grade 10 topics should be reduced to allow the teachers and learners to finish the syllabus in good time and allow revision to take place.
- There should be the coherence of facts between topics of a specific Grade and between the Grades. The Grade 9 syllabus in the Life and Living must provide background information for mastering more complex topics in Grade 10.
- The teachers should be actively involved in decisions pertaining to teaching and learning their subjects because they have experience.

REFERENCES

Ausubel, D. P. (1962). A subsumption theory of meaningful verbal learning and retention. *The Journal of General Psychology*, *66*(2), 213-224.

Ausubel, D P. 1968. *The psychology of meaningful learning; an introduction to school learning*. New York: Grune and Stratton.

Ausubel, DP 1980. Schemata, cognitive structure, and advance organisers: A reply to Anderson, Spiro, and Anderson. *American Educational Research Journal*, 17(3):400-404.

Brown, H. Douglas. 1972. Cognitive pruning and second language acquisition. *Modern Language Journal* 56: 218-222.

Creswell J N 2009. *Research design. Qualitative and quantitative and mixed methods approach* 3rd edition. Thousand Oaks: Sage

Denzin, NK & Lincoln, YS.(eds.). 2013. *The landscape of qualitative research: Theories and issues*. Sage.

Department of Basic Education (DBE). 2011. *Life natural sciences. Curriculum and policy statement (CAPS).* Pretoria: Department of Basic Education

De Villiers, R. 2011. Student teachers' views: what is an interesting Life Sciences curriculum? *South African Journal of Education* 31:535–548.

Fisher, D, Hafner, C & Young, J. 2007. Integrating independent learning: Lessons learned and implications for the classroom. *Learner autonomy: Integration and support.* Dublin: Authenti*k*.

Fisher, KM, Wandersee, JH & Moody, DE 2000. *Mapping biology knowledge*. London: Kluwer Academy.

Gibbons, Pauline (2015). Scaffolding language, scaffolding learning: teaching English language learning in the mainstream classroom. Portsmouth: Heinemann

Greeno, JG, Collins, AM & Resnick, LB. 1996. Cognition and learning. In *Handbook of educational psychology*, edited by DC Berliner & Newmann, Smith, Allensworth & Bryk, . Calfee (pp15–46). New York: Simon Schuster MacMillan.

Hoadley, U & Jansen, J D. 2009. *Curriculum: Organizing knowledge for the classroom.* Oxford University Press Southern Africa.

Hoets, H. 2012. *Focus group questionnaire fundamentals-basic questions.* Retrieved 19 October 2016, from http://www.focus grouptips.com/focus group questionnaire.html.

Jensen, EA & Laurie, C. 2016. *Doing real research: a practical guide to social research.* Thousand Oaks, CA: Sage.

Kipo, DD. 2013. Mixed Methods Research: reflections on social public policy. *Asian Social Science* 9(17):259–268.

Merton RK, Fiske, M & Kendal, PL 1990. *The focused interview: A manual of problems and procedures.* 2nd edition.. London: Collier MacMillan.

Mouton, J. 2003. *How to succeed in your master's and doctoral degrees: A South African guide and resource book*. Pretoria: Van Schaick.

Newmann, FM.1981. Reducing student alienation in high schools: Implications of theory. *Harvard Educational Review* 51(4):546–564.

Newmann, FM, Smith, B, Allenswork, E & Bryk, AS. 2001. Instructional Program coherence: What it is and why it should guide school improvement policy. *Educational Evaluation and Policy Analysi*s 23(4):297–321.

Nicholl, B, Flutter, J A, Hosking, IM & Clarkson, P J. 2013. Transforming practice in Design and Technology: evidence from a classroom-based research study of students' responses to an intervention on inclusive design. *Curriculum Journal 24*(1): 86-102.

Piaget, J. 1983b. *Possibility and necessity, The role of necessity in cognitive development (vol. 2)*. Minneapolis: University of Minnesota Press (Original work published 1981).

Roseman, JE, Stern, L& Koppal, M. 2010. A method of analysing the coherence of high school biology textbooks. *Journal of research in science teaching* 47 (1):47-70.

Saldana, J. 2016. *The coding manual for qualitative researchers*. Britain: Ashford Colour Press Ltd.

Sweller, J. 1994. Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction 4*(4): 295-312.

Tytler, R. (2007). Re-imagining science education: Engaging students in science for Australia's future. Camberwell, Australia: Australian Council for Educational Research (ACER) Press.

MITIGATE LITTERING THROUGH ACTION RESEARCH ACTIVITIES: AN ACTION-ORIENTED KNOWLEDGE-BASED ENVIRONMENTAL STUDY

Tsebo Kgoto Matsekoleng & Tomé Awsha Mapotse
48502928@mylife.unisa.ac.za; mapotta@unisa.ac.za;

Abstract

Ignorance and a lack of environmental awareness carry a tremendous cost for our fragile environment and human lives. As a result, uninformed human actions, imposed on the environment, manifest, amongst others, as littering. Littered items pollute water sources and pose a danger to people's health. This study intends to aid interested parties such as curriculum designers in implementing progressive environmental action research (PEAR) activities to reduce littering. The study resonates with critical theory and an action-learning paradigm, thus it anticipated exploring the extent to which PEAR activities integrate knowledge-based and action-oriented efforts to reduce littering. Fourteen Grade 8 learners were randomly selected from seven classes through convenience sampling, to serve as co-researchers in this study. The average size of the classes was forty-five. The researchers used the following research instruments to collect data including participant observation to observe daily activities, research journals to record research journey, questionnaires to evaluate awareness and attitude, and photographs to capture current situation, which were subsequently coded and analysed. The results of the study indicate that PEAR activities integrate knowledge-based and action-oriented efforts aimed at curbing littering. Therefore, PEAR activities which combine knowledge and action within a school setup could help to reduce littering, if implemented via an action research approach.

Keywords: action learning paradigm; action research; critical theory; environmental education; littering

INTRODUCTION

Many environmental issues (such as littering) that are incipient in society are largely driven by our modern lifestyles (Matsekoleng, 2017). Learners and teachers buy pre-packaged food products and fruit from their schools' tuck-shops and from vendors, then discard the

packaging waste materials on the ground, thus littering their school environments (Makonya, 2004). Their negative actions not only have an impact on the fragile environment, but also pose health risks to human beings – for instance, if litter blocks the outflow of a pond, the stagnant water can become a breeding ground for malaria mosquitoes such as anopheles. Thus, the presence of litter in a community exposes its members to diseases such as cholera, malaria and other air- and waterborne diseases (Ajaegbo, Dashit & Akume, 2012).

In our daily lives, we make decisions which, in one way or another, have an effect on the environment. For example, discarding sweet wrappers and food containers on the ground will result in litter causing not only health issues (sanitation), but also a bad smell within our living space. Such actions will harm the general aesthetic appeal of a neighbourhood and school environment.

Litter has been a major problem in both developed and developing countries worldwide (Mathe, 2014). Despite governments' best efforts such as collect a can campaign, most countries still struggle to reduce instances of littering. Throwing away items (intentionally or unintentionally) pollutes the environment, wherever they end up. Even though many littered items can be recycled, such as plastic bags people still throw them willy nilly.

Cleaning up litter costs the state a great deal of money, especially if council workers need to attend to the illegal dumping of garbage on streets and in vacant spaces. Littering has a negative impact on the Zoological gardens. For instance, tourism industry, as it degrades the appeal of an area which, thus lead to financial losses to the industry once tourists start staying away. It gives the impression that in the school context, certain factors influence learners' behavioural patterns when it comes to littering. This study has sought to identify and mitigate some of these problems by using progressive environmental action research (PEAR) activities, in collaboration with learners who served as co-researchers.

RESEARCH PROBLEM

Learners often have formal knowledge which is not applicable to their everyday life encounters. This mismatch between the intended and the implemented curriculum produces learners who have knowledge, yet fail to be action competent (Molapo, Stears & Dempster, 2014). This suggests that there is disjunction between knowledge and action, with teachers

only imparting knowledge to their learners. As learners are not aware of, or knowledgeable about, alternative environmentally friendly methods (Ifegbesan, 2010) to alleviate littering, they cannot implement them. Although in many extant studies school learners recognised that the prevalence of trash on the ground and elsewhere in the school was because they, themselves, had placed it there (Doan & Jablonski, 2012; Msezane & Mudau, 2014), this behaviour shows a lack of environmental awareness (EA) and action competence.

A study conducted by Msezane (2014) revealed that learners showed no concern about the negative impact of disposing of litter inappropriately, even after performing extramural activities related to classroom environmental education (EE). This indicates that they were not concerned about the environment at school or at home. The Msezane (2014) findings suggest that activities-infused knowledge had a minimal impact on learners. Primary school learners might know about possible solutions to deforestation but may not be sure how to manage solid waste (garbage) (Mutisya & Barker, 2011). This is because environmental actions are reduced to involving children in tasks such as clean-ups, planting trees and the like, without the necessary learning support to understand *why* such activities are worth undertaking (Silo, 2011). Hands-on, active education is one way in which children can learn about the environment and, more importantly, how to perform positive and repetitive environmental actions (McEwen, 2015). This study aims to close the identified gap by engaging co-researchers in PEAR activities which integrate knowledge-based and action-oriented tasks, to impart lifelong learning through a progressive, cyclical process. With respect to the identified gap, this study will be guided by the research question: How can environmental action research activities integrate knowledge and action to mitigate littering?

BROADENING ENVIRONMENTAL EDUCATION THROUGH ENVIRONMENTAL ACTION RESEARCH ACTIVITIES

EE is said to be action oriented, because it fosters teamwork and cooperation among learners through action (Komane, 2005). To be effective, such cooperation should include all relevant stakeholders – after all, reducing littering in public is everyone's responsibility. Hence, EE that integrates PEAR activities must be knowledge based and action oriented, because if reinforced, the acquisition of environmental knowledge (in theory and in practice) at school could lead to action in dealing with littering, as well as successful environmental management.

EE is an integral aspect of education that aims to provide learners with practical skills and adequate knowledge to care for the environment and eradicate environmental issues (including littering within their immediate surroundings) and to consider whether their actions towards the environment promote sustainable living. It further aims to instil in all stakeholders an awareness, as well as the necessary commitment, positive attitude, knowledge, values, skills and care, to act and solve the problem of littering (Komane, 2005). Care is a fundamental component of EE, as it encourages learners to make decisions that do not harm the environment (laudable actions include throwing garbage in litterbins to avoid contaminating the environment). This study aimed to use PEAR activities to impart knowledge to co-researchers using actions to reinforce what was learnt as part of a continuous, cyclical process.

- ## ENVIRONMENTAL EDUCATION AND THE CURRICULUM

EE content within the curriculum is structured into three categories, which include education *about*, *for* and *in* the environment. Subjects offered in different institutions of learning should ensure that all three types of education are included in lessons presented both inside and outside the classroom, so as to achieve the aims and objectives of EE and address littering within the immediate environment. The study conducted by Yeshalem (2013) revealed that the current practice of EE in schools did very little to teach learners *about, in* and *for* the local environment. Moreover, Stanišić (2016) indicated that teachers mostly applied frontal teaching and monologic method to teach environmental content to their learners. Consequently, this contributes inadequate environmental knowledge to the learners to deal with environmental issues such as littering. Accordingly, PEAR activities should incorporate these EE components in education, to reduce litter in schools. Possible activities could include setting up vegetable gardens, as this calls on learners (such as the co-researchers involved in this study) to use their hands, hearts and minds.

THEORETICAL FRAMEWORK

Theory in qualitative research helps researchers to frame their study and make sense of complex environmental issues in our biosphere. In this instance, critical theory helped the researchers devise questions and strategies to explore people's littering behaviour – in this

instance, that of schoolgoing learners (Steinberg & Kincheloe, 2010). Critical theory can conscientise co-researchers to be aware of their capabilities when it comes to challenging the problems that confront them on a day-to-day basis and might prompt them to invent solutions. Furthermore, critical theory can help to explain not only the causes and conditions of a certain scenario, but also the hidden potentials (Fuchs, 2016).

Critical theory emerged in Germany from the work of the Frankfurt School, and is derived from the writings of Karl Marx. Some 70 years after its development in Frankfurt, critical theory has retained its ability to disrupt and challenge the status quo (Kincheloe & McLaren, 2000), with the intention of emancipating those who are oppressed (in the sense of being unable to tackle larger issues, such as littering).

In the study on which this article is based, the researchers used PEAR activities in collaboration with their co-researchers to develop environmental awareness and mitigate littering. PEAR activities (such as compost making) opened opportunities for the co-researchers to learn about three Rs (reuse, reduce and recycle) utilising vegetable waste materials, and thus offered them strategies to overcome the risk of littering. As such, the PEAR activities incorporated knowledge-based and action-oriented tasks to ensure that learning, supported by action, took place.

This study aimed to move the co-researchers out of their comfort zones of accepting littering as the norm and aimed to conscientise them regarding the need to learn and live in a clean environment (Matsekoleng, 2017). Hence, this study involved co-researchers in a cooperative manner, using PEAR activities to empower them with action competencies aimed at curbing littering. In accordance with the action-learning paradigm, the co-researchers took control of their own course of action as it related to the problem (Marquardt & Waddill, 2004).

RESEARCH METHODOLOGY

The research approach focuses on the methods employed in carrying out some form of enquiry (Hammersley, 2011). This qualitative study employed an AR approach to explore the extent to which PEAR activities integrated knowledge-based and action-oriented tasks, to alleviate littering.

Data collection technique, data analysis and trustworthiness

The researchers used four data collection techniques, including an observation grid to observe daily activities, a research journal to record reflections, photographs to capture the current state of affairs, and a questionnaire assessing the co-researchers' awareness and insights. These instruments were used to generate data using a triangulation technique which established the truthfulness of the research findings. Researchers used qualitative content analysis to analysis collected data as it allows researchers to group data together into chunks and then assign them to broader categories of related meanings (Beziudenhout & Cronje, 2018). As such, qualitative research utilizes verbatim responses and coding processes to analyse data and address the credibility of that data. Words thus serve as imaginative elements of data collection, with the researchers making use of transcription and records of observed events as they unfold naturally in the research settings. The questionnaires were processed using the Microsoft Word and Excel programmes (applications software). This study was grounded in co-researchers' voluntary involvement, which implied that the co-researchers were entitled to withdraw their participation at any time. The co-researchers and their parents/guardians signed letters of consent, since the former were minors. Their right to privacy, along with that of their parents, was assured. Hence, the data collected were handled with care, and confidentiality was maintained.

Participants as representative of the population

The researchers used convenience sampling to select Grade 8 learners from a volunteer group. Two learners each from seven classes were the eventual co-researchers in the study. This type of sampling procedure was chosen because it is quick and cheap, and the researchers have easy access to the participants (Maree & Pietersen, 2008). This AR case study was conducted in Ekurhuleni South District, in a township known as Thokoza in Gauteng province. The researchers selected one secondary school within the research area. With five secondary and 12 primary schools in the vicinity, researchers selected the participating secondary school due to its close proximity, mindful of the period of the research project and the approach followed. In total, 14 co-researchers (13-15 years) acted as study participants, and while the findings could not be generalised to schools across the country, they were applicable to the school contexts existing in the area under study.

PEAR ACTIVITIES

PEAR activities were chosen based on the absence of environmental activities at the school, which fails to equip learners with environmental action and/or knowledge. Before implementation, the researchers and co-researchers held a seminar to discuss and put forward ideas for PEAR activities. A programme was subsequently designed to engage the co-researchers in PEAR activities. The researchers and co-researchers met on a weekly basis to discuss progress. An AR design was chosen to evaluate the effectiveness with which the PEAR activities enabled the co-researchers to integrate knowledge and action, as it allowed the researchers to take the former through the research processes of planning, action, observation and reflection (Mapotse & Mashiloane, 2017). The next section focuses on the research findings.

RESEARCH FINDINGS

This section summarises the PEAR activities conducted in a group effort (researchers and co-researchers) using a cyclical process (see Figure 1). The PEAR activities, conducted with the co-researchers through AR, occurred in spiral cycles which encompassed setting up a vegetable garden, making compost, crocheting, and designing and installing litterbins. In addition, these PEAR activities focused on several aspects such as the exploration of soil, organic waste and disused objects (litterbins). The cyclical PEAR activities were intended to mitigate littering by raising the co-researchers' awareness of this scourge and encouraging them to develop action competence, based on the notion of a relationship existing between action and reflection (Welskop, 2012).

Cycle 1, as shown in Figure 1, outlines the first activity in which the co-researchers took part, namely exploring the soil in preparation for a vegetable garden. The co-researchers started this activity after it they and the researchers observed that the school did not have a vegetable garden. As a result, a dumpsite was identified in the schoolyard as the ideal place to start such a garden. The identified land was prepared for months by removing hazardous items and working in compost to fertilise the soil. Subsequently, the co-researchers irrigated the land in preparation for cultivation. In performing these activities, the co-researchers were exposed to aspects of agriculture and the importance of fertile soil to our economy. The intention was to show the co-researchers that there are numerous ways in which to reduce litter, and that they should consider soil as a valuable part of their lives.

During the second cycle (see Figure 1), the PEAR activities aimed to raise the co-researchers' awareness of organic waste (e.g., vegetable peels, rests) and inorganic waste (plastic bags). During this cycle, the co-researchers collected vegetable waste materials from the school kitchen to make compost. Some co-researchers brought plastic bags from home, and some were collected such from the terrain around the school, to use in designing plastic mats. The intention behind these activities was to raise the co-researchers' awareness of waste and successful recycling.

In cycle three, the co-researchers (with the help of the groundsmen) designed and installed litterbins around the school, where there was a shortage of stationary and movable receptacles. Afterwards, the co-researchers painted and drew on the litterbins, in the hope that their decorations would capture other learners' attention and prompt them to use the bins. This activity encouraged their peers to keep the school terrain clean.
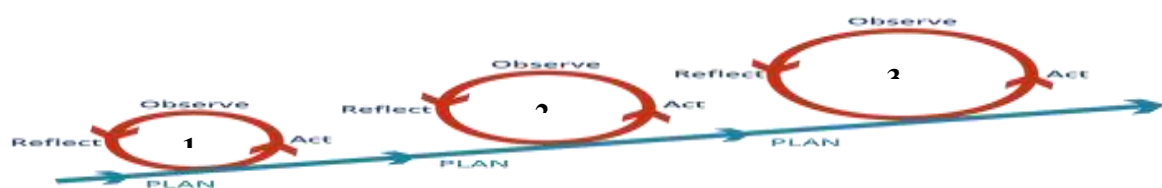
Figure 1: PEAR spiral cycles (adapted from O'Byrne 2016)

Figure 2: PEAR spiral cycles (adapted from O'Byrne 2016)

Table 1 summarises the co-researchers' PEAR activities per spiral cycle, as developed from Figure 1.

Table 1: Summarised co-researchers' activities per cycle

PEAR cycle	Co-researchers' activities
Spiral cycle 1	Exploration of the soil
Spiral cycle 2	Reuse and recycling of organic waste materials
Spiral cycle 3	Repurposing of disused objects (litterbins)

The PEAR activities stated above afforded the co-researchers a place-based learning curriculum, because they underwent experiential learning (Hall, 2015) in acting and proposing solutions to curb littering in their schools. These PEAR activities integrated knowledge-based and action- oriented tasks to raise the co-researchers' awareness of littering, since most of the activities were conducted outside the classroom. One of the PEAR activities that was conducted inside the classroom was crocheting. The co-researchers who were involved in the outdoor education activities used their senses, muscles, hearts and brains, and enjoyed being out in nature, but also learned something in the process (Torkos, 2017). Moreover, the learners' participation in waste management activities could be transformed into action competencies targeted at influencing their peers, by engaging various mediating tools or available resources (Silo, 2011). The co-researchers in this study were engaged in various PEAR activities (soil exploration, the re-use and recycling of waste materials, the installation of litterbins) that integrated knowledge-based and action-oriented activities.

DISCUSSION

In this study, PEAR activities involved environmental campaigns designed to conscientise the co-researchers about litter-related issues, by integrating knowledge- and action-based activities. The co-researchers conducted numerous PEAR activities, such as compost making, learning to crochet, designing school environmental policy to guide the development of action plans, setting up a vegetable garden and installing litterbins. These PEAR activities were targeted at curbing littering and raising the co-researchers' awareness of this scourge. Since the co-researchers used a hands-on approach, the study is indicative of action research. Amini (2015) argues that using outdoor learning when teaching EE has been proven to be effective in improving learners' learning outcomes, especially in fostering a caring attitude towards the environment. In this regard, Mutisya and Barker (2011) emphasise that EE should go beyond knowledge about the environment to actions being taken. Hence, the PEAR activities were conducted in progressive AR spiral cycles, to empower the co-researchers through knowledge and action.

EE, when taught to learners, gradually starts with the sorting of garbage, the use of rubbish and lessons on hygiene, before progressing to the cultivation and care of plants (Amini, 2015). In this study, the co-researchers progressively went through the process of exploring the soil, utilising waste materials, and designing environmental monitoring tools, such as a

school environmental policy and litterbins. The co-researchers thus developed knowledge, skills and appropriate attitudes towards their environment (Maluleke, 2015).

Sehlola (2007) reports that the classroom alone is not sufficient if the aim is to inculcate environmental learning – it should be accompanied by practical experience outside of the classroom. As a result, the co-researchers were taken through progressive AR processes of acting, observing and reflecting, and continued planning. For instance, the process of creating a vegetable garden involved turning a dumpsite into fertile soil through applying compost, irrigating the garden and cultivating seeds/seedlings and sustained nurturing. This process is indicative of a knowledge-based, action-oriented approach, and was successfully conducted. Cross (2013) points out that the environmental lessons and hands-on experience provided by cultivating a school garden may be an effective method to promote EA amongst youths.

Molapo et al. (2014) state as key to the translation of knowledge into action, aspects such as ownership and empowerment. In this study, the co-researchers were conscientised by crocheting mats using discarded plastic bags – a process facilitated by two of the co-researchers. Some of the plastic bags were retrieved from the environment, thus raising the co-researchers' awareness of the wastefulness of littering. In addition, a recognition of littering as an environmental problem resulted in the co-researchers designing a school environmental policy to serve as a guide for future actions to discourage littering. Litterbins were installed on the school grounds as another means of curbing littering and raising awareness. These PEAR activities show that the co-researchers took ownership of their school terrain and were subsequently empowered to help combat littering.

A study by Mutisya and Barker (2011) revealed that majority of the learners do not know how to handle organic and/or inorganic waste. This suggests that learners are infrequently involved in environmental activities, or that there is a lack of such activities. In this study, the co-researchers were exposed to waste materials and learned how to handle such materials in an eco-friendly manner, and to conscientise older people such as food handlers. This is an indication that PEAR activities had a positive effect on the co-researchers, in addition to integrating knowledge and action.

CONCLUSION

The study is guided by this research question: How can environmental action research activities integrate knowledge and action to mitigate littering?

The information collected from the four research instruments in this study, revealed that PEAR activities integrated knowledge-based and action-oriented tasks aimed at mitigating littering. These activities empowered the co-researchers to turn a dumpsite into a vegetable garden, vegetable and food waste materials into compost, plastic bags into crocheted mats and steel water drums into litterbins, in addition to helping them implement an environmental policy for one of the schools. Therefore, the results of the study show that PEAR activities were successfully conducted to combat littering, by incorporating both knowledge and action. Thus, close the gap as above studies such as Stanišić (2016) and Yeshalem (2013) discovered learners are not exposed to learning *about, in* and *for* the environment as teachers make use of one or two teaching methods such as lecturing in their classrooms. This study shared strategies that teachers in schools could use to conscientise learners towards littering.

These PEAR activities integrated three components of education about, for and in the environment. For instance, the co-researchers identified a dumpsite which they converted into a vegetable garden; they turned vegetable waste material into compost to fertilise the soil; then cultivated seeds/seedlings; irrigated the garden and nurtured the plants which sprouted. PEAR activities provide strategies that teachers and relevant stakeholders may implement to address littering and raise learners' awareness of this scourge. Coertjens, Boeve-de Pauw, De Maeyer and Van Petegem (2010) suggest that schools could stimulate learners' EA by teaching in a more hands-on manner. If such teaching is approached through a participatory teaching method, it would integrate knowledge and action to achieve the desired outcome(s). Participatory methods grant learners an opportunity to participate in the learning process and construct knowledge (Kimaryo, 2011). Learners need to be more than just educated; they need to be taught how to act (McEwen, 2015), as was the case in this study.

Based on the stated PEAR activities and related discussions, it is vital to integrate knowledge-based and action-oriented efforts aimed at curbing littering. To ensure the effectiveness of PEAR activities, action research is indispensable in efforts to optimally reduce the problem of littering within a community.

REFERENCES

Ajaegbo, E., Dashit, S. I., & Akume, A. T. (2012). The determinants of littering attitude in urban neighbourhoods of Jos. *Jorind*, *10*(3), 82–94.

Amini, R. (2015). Outdoor-based environmental education learning and its effect in [establishing a] caring attitude toward the environment. *Indonesian Journal of Science Education*, *4*(1), 3–47.

Beziudenhout, R & Cronje, F. (2018). Qualitative data analysis. In F. Plooy-Cilliers, C. Davis & R. Beziudenhout (Eds.), *Research matters* (7th ed.), pp. 228–251. Cape Town: Juta and Company Ltd.

Coertjens, L., Boeve-de Pauw, J., De Maeyer, S., & Van Petegem, P. (2010). Do schools make a difference in their students' environmental attitudes and awareness? Evidence from PISA 2006. *International Journal of Science and Mathematics Education*, *8*(3), 497–522.

Cross, B. A. (2013). *The impact of a school garden and environmental education on the environmental awareness of fifth graders*. MA dissertation. Louisiana: Southeastern Louisiana Hammond University.

Doan, K., & Jablonski, B. (2012). In their own words, urban students make suggestions for improving the appearance of their schools. *Urban Review Journal*, *44*(5), 649–663.

Fuchs, C. (2016a). Critical theory. In *International encyclopedia of political communication*, ed. G. Mazzoleni, K. Barnhurst, K. Ikeda, R. Mai & H. Wessler. Hoboken, NJ: Wiley-Blackwell.

Hall, R. (2015). *Implementing place-based education in the elementary classroom*. MEd dissertation. Toronto: University of Toronto.

Hammersley, M. (2011). *Questioning qualitative inquiry: Critical essays*. London: Sage.

Ifegbesan, A. (2010). Exploring secondary school students' understanding and practices of waste management in Ogun State, Nigeria. *International Journal of Environmental and Science Education*, *5*(2), 201–215.

Kimaryo, L. (2011). *Integrating environmental education in primary school education in Tanzania: Teachers' perceptions and teaching practices*. DEd thesis. Turku: Åbo Akademi University.

Kincheloe, J. L., & McLaren, P. L. (2000). Rethinking critical theory and qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed.), pp. 279–313. Thousand Oaks, CA: Sage.

Komane, F. (2005). *The assessment of environmental awareness of secondary school learners in the Mabopane district*. MSc dissertation. Potchefstroom: North-West University.

Makonya, W. (2004). *A study of litter problems in selected secondary schools in Bulawayo*. MEd dissertation. Pretoria: University of South Africa.

Maluleke, H. M. (2015). *Curriculum policy implementation in the South African context, with reference to environmental education within the natural sciences*. DEd thesis. Pretoria: University of South Africa.

Mapotse, T. A., & Mashiloane, T. K. (2017). Nurturing learners' awareness of littering through environmental campaigns: An action research approach. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(10), 6909 – 69021.

Maree, K., & Pietersen, J. (2008). Sampling. In K. Maree (Ed.), *First steps in research* (2nd ed.), pp. 171–181. Pretoria: Van Schaik.

Marquardt, M., & Waddill, D. (2004). The power of learning in action learning: A conceptual analysis of how the five schools of adult learning theories are incorporated within the practice of action learning. *Action Learning: Research and Practice*, *1*(2), 185–202.

Mathe, R. (2014). *Effects of the biographic factors and religious convictions on littering to enhance waste management in Pretoria city*. MSc dissertation. Pretoria: University of South Africa.

Matsekoleng, T. K. (2017). *Learners' environmental awareness, effects on home and school practices towards littering: An action research case*. MEd dissertation. Pretoria: University of South Africa.

McEwen, K. E. (2015). *The primary school factors that shape the environmental knowledge, attitudes, and behaviours of children*. MSc dissertation. Hamilton: University of Waikato.

Molapo, L., Stears, L., & Dempster, E. (2014). Does formal environmental knowledge inform the everyday practices of senior secondary Biology learners in Lesotho? *Southern African Journal of Environmental Education, 30*(1), 118–127.

Msezane, S. B. (2014). *An exploration of the impact of environmental education innovation on students in sustaining land resources: A case of Mkhondo village*. MEd dissertation. Pretoria: University of South Africa.

Msezane, S. B., & Mudau, A. V. (2014). Reconnoitering the stimulus of environmental education in reducing improper solid waste disposal: A case of St Marcia School in the Mkhondo village in Mpumalanga in South Africa. *Journal of Human Ecology*, *48*(3), 367–374.

Mutisya, S. M., & Barker, M. (2011). Pupils' environmental awareness and knowledge: A springboard for action in primary schools in Kenya's Rift Valley. *Science Education International, 22*(1), 55–71.

O'Byrne, W. I. (2016). Four steps to conducting action research in the classroom. Retrieved at: https://wiobyrne.com/action-research/ (accessed
on 10/04/2018).

Sehlola, M. S. (2007). *A case study of the integration of environmental learning in the primary school curriculum*. MEd dissertation. Pretoria: University of Pretoria.

Silo, N. (2011). Children's participation in waste management activities as a place-based approach to environmental education. *Children, Youth and Environments, 21*(1), 128–148.

Stanišić, J. M. (2016). Characteristics of Teaching environmental education in primary schools. *Inovacije u nastavi-časopis za savremenu nastavu*, *29*(4), 87-100.

Steinberg, S. R., & Kincheloe, J. L. (2010). Power, emancipation, and complexity: Employing critical theory. *Power and Education*, *2*(2), 140–151.

Torkos, H. (2017). Social and psychological aspects of outdoor education. *Agora Psycho-Pragmatica*, *1*(1), 215–223.

Welskop, W. (2012). Action learning in education. Retrieved at: http://depot.ceon.pl/handle/123456789/1286 (accessed on 30/04/2018).

Yeshalem, A. D. (2013). *Environmental Education about, in and for the Environment: The case of two secondary schools in Ethiopia*. MEd Dissertation. Oslo: University of Oslo.

EXAMINATION OF THE CONSTRUCTIVIST THEORY IN TEACHING AND LEARNING IN ADULT NON-FORMAL EDUCATION CENTRES IN KWAZULU-NATAL

Celestin Mayombe

University of KwaZulu-Natal, South Africa

celestin-may@hotmail.com

Abstract

In South Africa, adult non-formal education (NFE) programmes do not only open the doors of learning, but also provide to non-educated and unskilled learners the opportunity to acquire marketable skills in order to access the means of living. The main concern in this paper is that graduates from NFE programmes experience challenges in acquiring employability skills due to the ineffectiveness of teaching and learning methods used the adult NFE centres of KwaZulu-Natal. This paper examined the application of constructivist theory in teaching and learning process at adult NFE centres in order to help graduates acquire employability skills. The researcher used the mixed of stratified and purposive sampling methods to select six NFE centres and 12 (out of 200) learners who studied skills training and became self-employed for semi-structured interviews. The findings revealed that the majority of learners viewed the methods of teaching and learning used to foster the acquisition of employability skills were practice-oriented in the real situation similar to the future workplaces. The researcher concludes that the approaches in teaching and learning in adult NFE centres were effective in connecting training contents to the labour market reality of the learners.

Keywords: Adult education, non-formal training, employability skills, constructivist theory, skills acquisition, South Africa.

Introduction

In South Africa, adult non-formal education (NFE) programmes do not only open the doors of learning, but also provide to non-educated and unskilled learners the opportunity to acquire marketable skills in order to access the means of living. Based on its vision of providing a better life for all its citizens, the government places great emphasis on adult non-formal education and training linked community development (McGrath & Akoojee, 2009; Mosoetsa, 2011). In KwaZulu-Natal (KZN) province where this study was conducted,

unemployment due to the lack of employability skills and employment opportunities is one of the major challenges. As a result, these unskilled adults have little or no access to economic opportunities in KZN (Mosoetsa, 2011). Therefore, the government of KZN has set a vision to provide literacy and skills development to all citizens.

The KZN government uses adult education and training programme as one of the tools to reduce unemployment due to the lack of employability skills. In the document *KZN Human Resource Development Strategy and the Development of an Implementation Framework (2016-2030*), emphasises that adult education and training is an important component of the skills development structure for serving unemployed adults (KZN, 2016). Like formal education, adult NFE is crucial for the improvement of human capital, hence enabling poor people to participate in income-generating activities. To this end, KZN government committed itself to serve unskilled adults by "providing formal and non-formal education and skills based programmes that are responsive to socio-economic problems such as illiteracy, unemployment and poverty" (Department of Higher Education and Training [DHET], 2016, p.11).

There is abundance of literature on adult education for poverty reduction in the poor and developing countries, but few in teaching and learning methods. Previous studies focused on challenges in delivering NFE programmes in the African context (Hussein, 2013; Manuel, Van der Linden & Popov, 2017). Others established a link between adult education and income generating in terms of skills acquisition and employment outcomes (Shikukumwa, Kanyimba & Shalyefu, 2016; Adedokun & Oluwagbohunmi, 2015). Still other scholars examined the impact of adult NFE on reducing poverty and educational attainment of children (Olufunke, 2013; Adedokun, 2014; Dekola & Ngozi, 2016). However, there is a little knowledge on the theory-based approach of teaching and learning for employability skills in the NFE centres. Though there are previous studies on adult NFE, a little is known about teaching and learning techniques helping the learners to acquire skills and fostering skills utilisation after graduating.

Objectives of the Study
The purpose of this paper is to examine how teachers applied the constructivist theory in teaching and learning process in adult non-formal education centres in KZN. The paper

focuses on how the use of the constructivist theory fostered active participation of the learners and skills acquisition of the adult learners. The paper aims at achieving the following objectives:

- To examine the use of interactive learning for active participation by adult learners.
- To examine the use of collaborative learning for active participation by learners.
- To examine how the teachers applied authentic learning in teaching-learning process.

Research Questions

- How did teachers use of interactive learning for active participation by adult learners?
- How did teachers use of collaborative learning for active participation by learners?
- How did the teachers apply authentic learning in teaching and learning process?

In the context of this paper, employability skills are the transferable skills needed by adult individual to become 'employable' in their field of training. These skills enable NFE graduates to find a job in the local community or create their own small business to the best of their abilities.

Theoretical framework

This paper uses constructivist theory of teaching and learning in adult NFE centres. Though many scholars differently interpret constructivism, Nagowah and Nagowah (2009, p.280) note that, "constructivism is a learning theory that is actively constructed in the mind of the learners out of their experiences in the world". This paper analysis the findings through three instructional principles of constructivism theory according to Huang (2002). Firstly, 'interactive learning', which stresses that learners interact with the materials, each other and the teacher in an active way. According to Khanal (2014), interactive learning is a means of teaching whereby the teachers actively involve the learners in their learning process through teacher-leaner interaction, learner-learner interaction and hands-on demonstrations. The learners are always encouraged to be active participants. The interaction encompasses group works, discussions and dialogue between adult learners and the teacher.

Secondly, "collaborative learning", which entails peer exchanges of ideas, skills among learners (Huang, 2002). Kaye (in Khanal, 2014, p.97) defines collaborative or cooperative

learning as "the acquisition by individuals of knowledge, skills or attitudes occurring as the result of group interaction." Collaborative learning stresses that "learner do not learn in isolation from others, [rather,] people naturally learn and work collaboratively in their lives" (Huang, 2002, p.32). Thirdly, the 'authentic learning' of constructivism emphasises that "learning must be lifelike and that learning needs to meet real life experiences" (Huang, 2002, p.33). This principle encompasses learning by doing through simulation-based learning.

The application of these three principles of learning may be possible if the adult NFE centres use curriculum tailored according to learners' prior knowledge, experience and background. According to Khanal (2014, p.96), the "major implications of constructivism for learning environment of adult education entail using curriculum adapted to learners' prior knowledge, tailoring of teaching methods to learners' background and employing open-ended questions that stimulate dialogue among learners". In the context of this paper, the three principles appear useful because adults easily and quickly learn through hands-on activities that stimulate to use five senses and the mind.

Methodology

The study used qualitative research design for knowing how the learning approach was related to the needs and objectives of the learners. The qualitative approach allowed the researcher to view the reality as is experienced from inside out by the learners on a particular finding for a thorough understanding (Creswell, 2009). The study used qualitative method in terms of semi-structured interview and observation (Creswell, 2009, p.204). The sample was drawn from the district of uMgungundlovu (Msunduzi), selected because it has diversity in geographic areas (Urban, rural and peri-urban).

The population for the study was the adult learners who studied skills training at NFE centres of KZN. There is no document reporting the exact number of NFE centre in KZN, and most of NFE centres managed by NGOs are not registered with the provincial and national Department of Education (KZN, 2017). This is why it was impossible to obtain the population size of the centres and learners studying skills training programmes. However, as the study the original involved both quantitative method (with 200 learners) and qualitative method (with 12 self-employed learners), this paper reports on qualitative approach.

The researcher used stratified sampling to select six NFE centres, meaning that two centres were selected from each geographic setting (urban, rural and peri-urban areas). Then, he used the purposive sampling method to select 12 (out of 200) learners who studied skills training and became self-employed for semi-structured interviews. The selection criteria for twelve learners were as follows:

- Being self-employed after completing the skills training programmes;
- Being selected according to the type of skills training (technical and/or entrepreneurial);
- Being selected according the type of micro-enterprise activity, gender and areas (urban and rural) of the NFE centre.

The researcher conducted one-on-one semi-structured interviews with 12 self-employed learners. The semi-structured interviews focused on the components of teaching and learning techniques in the classrooms and workshops. The analysis and interpretation of the data from semi-structured interviews were done using thematic analysis. According to Nieuwenhuis (2012), a 'theme' is an attribute, descriptor, element generated from the interview text. The researcher coded the data from semi-structured interviews, then sorted and classified them to find common themes and sub-themes (Bryman, 2008). The researcher assigned each category a label. The codes and themes provided an understating of the raw data after the researcher put names for the descriptions and interpretation.

To ensure the validity of the questions, the researcher submitted the interview schedule to the reviewers who are specialist in the field of adult education for an assessment. The corrections and advice from the reviewers made the questions in interview schedule valid. The reliability of the data and findings was obtained through the researcher's position of objectivity and the purposive sampling method. In addition, during data collection process, the researcher clearly explained in detail the objectives of the study and the interview.

Findings

From the adult learners' view, the aim of this section is to examine how teachers applied the three principles of constructivist theory in teaching and learning process for active

participation by adult learners for enhancing skills acquisition in adult NFE centres. This section presented the key findings by discussing with theoretical framework and previous studies on adult NFE programmes.

Interactive learning

In order to find out how teachers were using the interactive learning within constructivism theory, leaners were asked to explain the way their teachers were helping them to participate actively in the process of learning. A learner from in urban area explained the teaching method by saying:

> *Our teachers motivated us to learn in the classroom and workshop by allowing us to ask questions where we did not understand. Each learner could express his or her view to the teacher and to other learners. Personally, I was motivated in the classroom and workshop and wanted to learn more and more. Our teachers used to ask us to give our views on particular aspect of skills and knowledge. What I can say is that teachers were using different ways in helping us to have skills in agriculture.*

Another adult learner from rural area who studied poultry and craft mentioned the following:

> *It was easy to understand the training course in poultry because after receiving explanation from our teachers, we used to teach each other again as learners. This means we could learn many things when sharing our experience with our teachers and classmates. We used to ask so many questions to our teachers during the practical sessions in the workshop and farms.*

The analysis of these quotes reveals that the approaches of teaching and learning had the aspects of interactive learning in the classrooms and outside for some NFE centres. Responses from all 12 learners indicated that after explaining or demonstrating some key concepts and skills, there was a time for questions and answers including open discussions between the teachers and the learners. In the classrooms, leaners were able to express views drawn from their life experience. Furthermore, the interaction between learners and teachers or between learners themselves existed even in the workshops and gardens for practical sessions. The teachers used to encourage learners to be active participants in their group

works and discussions. The inference from the findings is that learners viewed that the approach of teaching and learning for skills acquisition was practice-oriented.

Collaborative learning

Learners were asked to describe how they were learning from each in discussion groups and during practical sessions. The question aimed at determining whether learners were learning collaborative in active participation. During one-one interview, one leaner from urban NFE centre who studied sewing and fashion design reported the following:

> *Teachers used to give us projects to create and sew garments in latest fashion that is not common today in Pietermaritzburg. Each group could search latest fashion for women around the world. Working in small groups, we shared our knowledge, skills and previous experience to sew a good garment in the workshop. We then explained the work during class presentation.*

Another leaner who studied sewing and fashion at a different centre, explained the use of collaborative learning for active participation by learners by saying:

> *Our teachers were giving us topics on small business management to discuss among ourselves, then report to class. Everyone in the class had to be involved in the discussions and our teachers used to encourage every learner to contribute. I can still remember, our teachers divided us into small groups and asked us to solve certain problems of small business management.*

The analysis of these quotes reveals that working in a small group helped some learners to learn from peers who may have more knowledge, skills and experience than others. During the interviews, eight learners reported that the collaboration between themselves helped to acquire knowledge from their classmates who had prior learning experience on particular technical or entrepreneurial skills. In their small groups for class activities of projects, learners were able to discover knowledge and find solutions to the real life problems.

Authentic learning

As mentioned above, the analysis of authentic learning entails finding out whether the teaching-learning process was realistic in order to meet real life experiences of the learners. To this end, the research asked the learners to mention the activities they were involved in the classroom or workshops, and how they were related to their needs and objectives. Seven learners reported that class activities were practical and linked to their needs, objectives, and prior experience. One learner from a centre in peri-urban area said:

> *As we were learning technical skills in sewing, our educators kept informing us about small business opportunities in our communities and marketing strategies. During the training period, we also used to attend workshops on small business marketing.*

A second learner also reported:

> *Our centre manager and trainers used to organise visits and workshops outside for us so we might learn new skills related to fashion design and sewing and gain experience. We often travelled to conferences and clothing industries to the practical exposures. The field visits to workshops and industries and other places helped us to connect acquired skills to the world of work.*

The analysis of these quotes shows that field trips provided opportunities for the learners to connect their previous experience to the skills training contents and future employment (authentic learning). Furthermore, 10 respondents reported in the interviews that they used to perform real work activities at the workshops and to show processes and the steps to produce a product in the way the teachers taught. After receiving guidelines from a teacher, a learner was required to demonstrate the acquisition of specific skills. These findings mean that the teaching-learning process included the elements of 'learning by doing', which is similar to experiential learning.

Discussion of findings

The interaction between learners and teachers or between learners themselves enabled an effective teaching-learning process in the classrooms and workshops for practical sessions. This finding concurs with Harkema and Popescu's (2015) argument, who pointed out that

interactive approach to learning is beneficial in making the learners more active in acquiring knowledge and skills. In the context of Tanzania, the findings are in agreement with Ngusa and Makewa's (2014) argument that the interactive learning through discussions between teachers and learners in the classrooms or workshops helped the learners to share their experience acquired from their communities prior to the enrolment for the training course. Connecting these arguments to the present findings and the theoretical framework, the inference is that the class discussions resulted in the improvement of adult learners' level of skills acquisition at benchmark.

The 'collaborative learning' approach of teaching and learning helped the learners to pursue knowledge from peers who may play a role of mentors. This approach of teaching and learning allowed the learners to exchange idea and experience during theory and practical lessons (Khanal, 2014). A similar study by Pai and Mallya (2016) revealed that collaborative learning approach produced good results when the teachers motivated the learners to engage in group-learning experiences or actively participate in classroom activities. Connecting the present study to the theoretical framework, the inference from the findings is that the collaborative learning approach helped the adult learners to become keen to acquire more knowledge and skills from their classmates who had advanced knowledge in the training course.

As the principle of authentic learning, the teaching-learning process included the elements of 'learning by doing' through trips, which is similar to experiential learning. In other words, the learners learnt skills related to their work experience already accumulated from their local communities. These findings support the view of Khanal (2014) who argued that, authentic learning always encourages adult learners to expose themselves to an environment allowing them to learn by doing in the real world of work. The findings also concur with the argument of Ngusa and Makewa (2014, p.3) who pointed out that field trips and other activities that take place outside the classroom are powerful means through which learners can be actively involved in practical learning.

The implication of the theoretical framework to the research findings is that interactive learning, collaborative learning and authentic learning were useful to the training delivery approach in the NFE centre in KZN. When teachers applied the constructivist theory, they

facilitated the learners to teach each other and share their experience during theory and practical lessons. This is because the principles encouraged active participation of the learners in classroom or workshop activities and made them creative in the teaching-learning process while using problem-solving approach.

Conclusions

From learners' view, this paper was confined to examine on how teachers applied the constructivist theory in teaching and learning process for active participation by adult learners to enhancing skills acquisition in adult non-formal education centres in KwaZulu-Natal. Firstly, with regard to the principle of interactive learning, the interaction included group works, discussions among themselves or between leaners and the teachers. Secondly, collaborative learning entailed a cooperative learning through group work projects assigned by the teachers. Thirdly, teaching and learning approaches had a form of the authentic learning because teachers were linking lesson contents to learners' prior experience and involved field trip activities, which fostered learners' active participation and skills acquisition.

In connection with the findings, the researcher concludes that that the approaches in teaching and learning in adult NFE centres were effective in linking the training contents to the labour market reality of the adult learners. The findings imply that the majority of learners viewed that the methods of teaching the training courses fostering the acquisition of employability skills were practice-oriented in the real situation similar to the future workplaces. The implication the theoretical framework to the research findings is that interactive learning, collaborative learning and authentic learning were useful to the training delivery approach in the NFE centre in KZN. When teachers applied the constructivist theory, they facilitate the learners to teach each other and share their experience during theoretical and practical lessons.

Recommendations

There are three recommendations resulting from findings and theoretical framework. Firstly, teachers should rely on the active participation of learners instead of passive learning. Secondly, the teaching-learning process in the adult NFE centres should emphasise the interaction between the learners and materials, each other and the teacher in an active way.

Thirdly, the teaching should emphasise on deep learning with the intention to foster the application of the skills in the real-life situations.

References

Adedokun M.O. (2014). Inclusive Education and the Development of Nigerian Communities. *International Journal of Academic Research in Progressive Education and Development, 3(1), 28-40.*

Adedokun, M.O & Oluwagbohunmi, M.F. (2015). Capacity Building through Adult Education Programmes for Poverty Alleviation in Nigerian Communities. *Journal of Emerging Trends in Educational Research and Policy Studies* (JETERAPS) *6(7), 259-264.* Retrieved from http://jeteraps.scholarlinkresearch.com/articles/ CapacityBuildingthrough AdultEducationProgrammes.pdf.

Creswell, J.W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed). Los Angeles: Sage Publication, Inc.

Dekola, G & Ngozi, O.A. (2016). Impact of Adult Education on the Achievement of Government Poverty Alleviation Programmes in Owerri North and West Local Government Areas in Imo State. *International Journal of Education and Evaluation, 2(3), 11-16.*

Department of Higher Education and training [DHET]. (2016). KwaZulu-Natal CET College Strategic Plan 2015/2016-2019/2020. Pietermaritzburg: Government Printers.

Harkema, S. & Popescu, F. (2015). Entrepreneurship education for adults: A case study. International conference "Education, Reflection, Development", ERD 2015, 3-4 July 2015, Cluj-Napoca, Romania. *Procedia - Social and Behavioral Sciences* 209 (2015), 213- 220.

Huang, H. (2002). Toward constructivism for adult learners in online learning environments. *British Journal of Educational Technology*, *33 (1), 27-37.*

Hussein, M. H. (2013). Challenges and emerging perspectives in adult education delivery in Nigeria. *European Scientific Journal*, *9 (13), 138-145.*

Khanal, P. (2014). Making virtual learning interactive and meaningful: Implication of constructivism for adult students. *International Journal of Research Studies in Education, 3(1), 91-102.*

KwaZulu-Natal Province (KZN). (2016). *Review of the Kwazulu-Natal Human Resource*

Development Strategy & the Development of an Implementation Framework (2016-2030). Pietermaritzburg: Government Printers.

Manuel, A.,Van der Linden, J. & Popov, O. (2017). Educators in non-formal vocational education and training in Mozambique: a plea for recognition and professionalisation. *International Journal of Lifelong Education*, *36 (3), 324-338.* Doi: 10.1080/ 02601370. 2016.1241311.

McGrath, S., & Akoojee, S. (2009). Vocational Education and Training for Sustainability in South Africa: The role of public and private provision. *International Journal of Educational Development*, *29 (2), 149-156.*

Mosoetsa, S. (2011). *Eating from one pot; the dynamics of survival in poor South African households.* Johannesburg: Wits University Press.

Nagowah, L. & Nagowah, S. (2009). A reflection on the dominant learning theories: Behaviourism, cognitivism and constructivism. *The International Journal of Learning*, *16(2), 279-285.*

Ngusa, B.M & Makewa, L.N. (2014). Constructivism experiences in teaching-learning transaction among adventist secondary schools in South Nyanza, Tanzania. *American Journal of Educational Research*, *2(11), 1-7*. Doi: 10.12691/education-2-11A-1.

Nieuwenhuis, J. (2012). Qualitative Research Designs and Data Gathering Techniques. In Maree, K. *First Steps in Research* (pp. 69-97). Pretoria: Van Schaik Publishers.

Olufunke, A.M. (2013). Adult Education Programmes for Poverty Reduction among People with Special Needs. *Journal of Educational and Social Research*, *3(3), 317-321*. Doi:10.5901/jesr.2013.v4n3p317.

Pai, V. & Mallya, M.M. (2016). Student-centered learning in classrooms: A strategy for increasing student motivation and achievement. *International Journal of Current Research and Modern Education (IJCRME), 1 (1), 409-415*. Retrieved from www.rdmodernresearch.com.

Shikukumwa, A.T, Kanyimba, A. T & Shalyefu, R. K. (2016). Entrepreneurs' Views on the Effectiveness of the Adult Skills Development for Self-Employment in the National Literacy Programme of Namibia. *Open Journal of Social Sciences*, *4, 203-212*. Retrieved from http://dx.doi.org/10.4236/jss.2016.46021

STUDENT-TEACHERS' REFLECTIONS ON THEIR EXPERIENCES OF IMPLEMENTATION OF FOUNDATION PHASE LIFE SKILL CURRICULUM

Deborah Avosuahi Aramsowan & Nontokozo Mashiya
University of KwaZulu-Natal

216074145@stu.ukzn.ac.za; mashiyaj@ukzn.ac.za

Abstract

This is an exploratory study that investigated student-teachers' reflections on how they experienced the implementation of foundation phase life skill curriculum and how it prepares them to carry out their teaching profession. The study adopted an interpretive paradigm and employed Brigg's theory of constructive alignment alongside Van den Akker concept of curriculum spiderweb. Twenty fourth-year foundation phase student-teacher that offered life skill module from their third year and had completed their teaching practice were purposively and conveniently selected for this study. The instrument for data generation were focus group structured interview and reflective essay writing. The generated data were analyzed thematically using deductive and inductive reasoning approaches. The findings from the study reveal that students lack implementation strategies relevant to Foundation Phase learners during their teaching practice, hence the students felt unfulfilled. The reasons stated by the students as challenges are faulty implementation strategies employed by Foundation Phase Life Skill teacher-educators, insufficient time allocated, unclear assessment feedback responses, the disparity between the contents learned in the university and the contents for Foundation Phase learners. Hence, they had difficulty in implementing the curriculum during teaching practice. The study recommended the following: reviewing the implementation strategies of the educators, reviewing the curriculum to include relevant contents to both student-teacher and learners. This will help to uphold the standard of foundation phase students and learners.

Keywords: Student-teachers' reflections, student-teachers' experience, Life Skill, Curriculum, Foundation Phase

INTRODUCTION

In South African and beyond, education is believing to be a remedy to all the divers' ills confronting the society today. Hence, the National plan on Higher Education (NHE) in South

Africa versus the Department of Basic Education (DBE) provides the framework and structures for designing and the implementation of teacher-education curriculum. (McDonald & Horst, 2007). To achieve this goal, the NHE councils made it mandatory for universities to employ new ways of preparing graduates for the reality of teaching in the South African context (Badat, 2016). Thus, the need for pre-service teacher training programmes in the preparation of a highly qualified teaching workforce, capable of inculcating life skills to foundation phase learners (Darling-Hammond, 2012). However, Kuhn and Rundle-Thiele, (2009) reported that to understand learning, student-teachers' reflection or viewpoint of the curriculum is important. Hence, this study explored student-teachers' experiences of Foundation Phase Teacher Education Life Skills Programme and above all how the curriculum is being implemented to equip them to carry out their teaching roles. The purpose of teacher education is to produce practicing teachers capable of imparting knowledge to learners. Mooi (2010) asserts that the efficacy of a teacher training programme is fundamentally the determinant of quality education to the learners. Perez (2015) supported Mooi's ideas by stating that effective facilitation of the curriculums will not only upgrade student-teachers academically but ensure the enhancement of their total well-being. However, reports on the international ranking of South African universities in terms of producing high-level skilled student-teachers have revealed that student-teachers are not well equipped for their teaching career (THE 2016; Meyer, Bushney & Ukpere, 2011). Furthermore, researchers such as Malechwanzi, Lei and Wang (2016); Khoza, (2015); Mkhwanazi, (2014); Makeleni (2013) all recorded students' reflections on their experiences of the curriculum, the result was that students felt dissatisfied with the training received due to their lack of implementation skill to teach what they learned at the University.

LITERATURE REVIEW

The following curriculum concepts such as teacher role, assessment, teaching and learning outcome, accessibility, resources and learning activities advocated by Akker (2009) and Biggs (2003) serve as a guide to the literature review. Twenty-first-century student-teachers are quite different from the student-teachers taught 15 or 20 years ago, hence the need for teacher-educators to employ thoughtful and functional methods of organizing instructions to address students' differences (Joseph, 2013; Darling-Hammond, 2012). Biggs (2003) further stated that effective teaching is in the teachers' ability to define the learning objectives, integrate relevant and various forms of assessment to the set objective and guide student-

teachers to actively participate in the learning processes, thereby helping them to construct their own learning. Teachers play a significant role in curriculum implementation, they are the figure model and a key connection between curriculum and practice (Crosby 2000; Bantwini 2010). Aregbeyan (2010) as well as Su and Wood (2012) stated that student-teachers appreciate lecturers that are efficient in aligning all the components of the curriculum to assist them to attain their learning outcome. Learning outcome according to Sebate (2011) plays a significant role in teaching and learning activities as it serves as a guide on what to teach and what student-teachers are expected to achieve, leading to purposeful instruction and assessment. However, Brooman, Darwent, and Pimor (2015) on their research on student-teachers' voices on higher education curriculum design and implementation reported that the rigid attitude of some lecturers to the prescribed outcome hindered student-teachers from flexibly engaging in the learning activities.

Furthermore, Akker (2009) reinstated that teaching and learning can only be beneficial when it is accessible to all the student-teachers regardless of their background in respect to their culture, gender, and status. Nevertheless, Smardon and Bewley (2007) discovered that the implementation strategies adopted by some higher institution educator do not favor all the student-teachers. The method of reading from the slides which are obtainable in our higher institutions only benefit those who are cognitively strong. To make teaching effective and constructive to student-teachers, Nakpodia (2013) as well as Khoza (2013) suggested various forms of teaching resources such as Cinematographic (movies, films, etc.), Pictorial (moveable pictures), and acoustic resources (listening activities), hardware, software and ideological ware resources for effective facilitation of the curriculum. However, Amory (2010) argued that it is not just enough to include technology in teaching and learning but the lecturer must have experience of the the subject content, and ideology in using these three various forms of resources to communicate learning. Similarly, Khoza (2013) admonishes teachers to engage in an authentic teaching activity to enable student-teachers to explore the real world. Maxine Green (2010), a social activist who contended for a democratic curriculum, indicated that teaching and learning activities should be made interactive and democratic, giving the student-teachers freedom to express their view during the teaching processes. She suggested that educators should associate their formal task with real-world activities such as role-play, storytelling, and creative songs which will enable student-teachers' active participation. Similarly, Waldrip, Fisher, and Dorman (2008) argue that good

assessment involves student-teachers while setting goals and criteria for assessment and performing tasks that measure meaningful instructional activities. The National Research Council (2013) specified four types of assessments which include baseline assessment, diagnostic assessment, formative assessment and summative assessment. However, the majority of the Foundation Phase public school teachers lack effective knowledge and skills of different forms of assessment practice hence they glued to summative (Mkhwanazi, 2014).

Additionally, Ogude, Oosthuizen, and Nel (2005) opined that raising student-teachers equipped with problem-solving skills that will, in turn, equip learners to adjust to volatile and unpredictable society, should be the focus of our higher institutions. In support of Ogude, Mooi (2010) declared that the efficacy of a teacher training programme is fundamentally the determinant of quality education to the learners. Perez, (2015) added that effective facilitation of life skills curriculums will not only upgrade student-teachers academically but ensure the enhancement of their total well-being. However, much has not been done on listening to students experiences on how the curriculum is implemented to prepare them to perform their teaching role. Hence, the purpose of this study is to explore the student-teachers' experiences of the implementation of Life skill curriculum, to close any existing gap and improve on the Foundation Phase Life skill programme.

Research Question

The research question explored in this study is, what are the student-teachers' experiences of the implementation of Foundation Phase Teacher Education Life Skills curriculum?

THEORETICAL FRAMEWORK

The study is structured by using Biggs (2014) Theory of constructive alignment that advocated for the integration of teaching and learning activities with an assessment to address the intended learning outcome. Van den Akker (2009) elaborated the theory into ten curriculum segments namely include rationale, goals, and content, teaching activities, resources, teacher role, accessibility, location, time and assessment which are to serve as a guide to curriculum designers and implementers. Teaching and learning commence with clearly stated rationales with comprehensive learning goals which Khoza (2013) explained as set learning outcome to be covered by student-teachers. Afterward, the selection of appropriate contents which the teacher educators administered to students by using divers'

pedagogical strategies. The teacher-educators are to employ teaching resources such as ideological ware, software, and hardware to accelerate teaching and learning activities ((Khoza, 2012). In addition, the concept of curriculum spiderweb posits that equal time is allocated to all the components of the curriculum during implementation. Furthermore, the curriculum must be accessible to the students irrespective of their culture, background, race or economic status. Teaching and learning activities must be accessible to all student-teachers. Akker, further suggested the choice of conducive location for teaching and learning activities and assessment to determine if the set goals are achieved or not (Giles & Earl, 2011). These curriculum spiderweb concepts are used as a guide to explore the student-teachers' experience of the implementation of the Life Skill Foundation Phase curriculum. However, findings from this study revealed that the teacher educators do not stick to these curriculum components during the teaching and learning activities. Hence, the majority of the students lack implementation strategies.

METHODOLOGY

This article is a qualitative case study that researched into foundation phase student-teachers' experiences of the implementation of life skills curriculum, how it prepares and equips them with the demanded 21st-century life problem-solving skills and identifying possible gaps in the programme that may result in strengthening the life skills modules. The study is situated within the interpretive paradigm. Focus group structured interview and reflective essay writing were used as an instrument to generate data from twenty final year foundation phase life skills student-teachers who had completed their teaching practice. Hence, they were purposively and conveniently selected to reflect on their experiences of the implementation of the life skill curriculum (Cohen et al., 2011). The generated data were analyzed thematically using inductive and deductive reasoning approaches. The generated data was examined, transcribed and critically listened to repeatedly before selecting relevant information that answered the question guiding the study. The data were analyzed according to the following steps: sorting out relevant information to the study, similar points are grouped to form themes, thereafter the themes are organized using the theoretical/conceptual framework of Biggs (2014) and Akker (2009). The researcher do not undermine the essence of ethics when carrying out a research study, hence all the protocols are duly observed. Gatekeeper and approval from the University of Kwa-Zulu Natal Research Ethics Committee were given, Letters, including informed consent, were sent to the participants, and their safety and

confidentiality were guaranteed based on Tangwa (2009) stated three ethical principles which are autonomy, non-maleficence, and beneficence.

FINDINGS

Five broad themes that emerged in this study were used as heading to present the findings; 1) the student-teachers' reflections on their rationale for studying foundation phase life skills module**.**
; 2) Students' experiences of the set curriculum learning goals and outcome.
3) Student's experiences of their curriculum: the implementation processes which they termed was not efficient enough to prepare them for their roles; 4) Students' reflection on time allotted for the life skill modules. 5) Student-teachers' experience of Assessment task, feedback and curriculum alignment.

Theme one: **The student-teachers' reflections on their rationale for studying foundation phase life skills module**
The students 'experience of the curriculum commences from their rationales for the choice of Life Skill Foundation Phase module. Hence the participants gave a passionate rationale for studying life skills modules. One of the participants gave her reasons as follow:

> *"Eish! there is a lot of problem in the society and I felt I could contribute to see how to be of help I want to make a change, many children are into drugs, I felt it is better to start with foundation phase children."*

This above comment shows that the concerns of the student for the society prompted her choice of foundation phase life skill module. The moral decadence in society among the youngsters, especially the high school learners should be the utmost priority of foundation phase educators. Some of the participants believe that starting with the foundation phase learners is the solution to the problem.
Another student supported the above comment by declaring that:

> *"I love children and want to touch their lives, and as a mother, I felt I need more information for me to be effective and to feed them with the right and quality information."*

The social ill, juvenile delinquency, high rate of teenage pregnancy, drug abuse, teenage school dropout, and many others that make the society unhealthy and unconducive to dwell in should be of great concerns to all foundation phase educators at any level. It is believed that imparting desirable norms and values as suggested in life skill module into foundation phase learners will help resuscitate the society back to normalcy.

Theme two: **Students' experiences of the set curriculum learning goals and outcome**

The course outline and the learning goals are clearly stated by the lecturers before the commencement of the teaching and learning activities. Most of the participants attested to it that the course outline and the goals were clear to them hence, they were aware of what is expected of them:

> *"The course outline is very clear because it states everything that the module lesson needed to cover before the end of the periods. It also states the activities that needed to be done in the module. I think the problem is with the teaching"*

However, other student felt dissatisfied with the set learning goals as she stated that some of them found it difficult to achieve the learning outcome. The effective approaches needed in achieving the learning outcome are not stated by the lecturers:

> *"Implementing the Life Skill contents to address the learning outcome during teaching and learning activities is the problem, the problem is with the curriculum and implementation; if I come to the class and you are not appealing to me but you are just speaking to yourself, I'm no longer coming to the class, I stay back."*

There was no dispute concerning the setting of learning outcome and objectives in the foundation phase life skill programme. However, they uniformly complained that they were not guided on how to achieve the learning outcome. The student-teachers suggested that every lecture should be made as practical as possible by the lecturers in their teaching activities.

Theme three: **Student's experiences of their curriculum: the implementation processes**

Currently, there is a shift in the implementation of the school curriculum in our higher institutions. The shift is on the improvement of the pedagogical approach of the higher

institution educators. However, the participants in this study believe that the implementation strategies of the foundation phase life skill module lack innovative and thus could not support them to perform their teaching role. Below are some of the findings:

> *The teacher educators only limit themselves to one method of implementation strategies, they need to employ varieties of strategies rather than just slide. The strategy of implementation is usually not interesting because they are not creative in introducing the module."*

A student agreed with the above comment but added that the life skill teacher educators are well learned but lack the implementation strategies:

> *"To me, I think some of the lecturers do not have the educational background, they lack the language to interpret the curriculum"*

The above quotations confirm that the implementation strategies of the university educators needed to be improved upon. The method of copying from the module into slides to be read to the student-teachers which many of the lecturers employed is not helpful nor efficient enough to prepare them to perform their roles.

Other student-teachers raised the issue that the implementation strategies only favor those students from advantaged background. It does not catered for all, meaning that the education is not accessible to all the student-teachers:

> *"The teaching method does not catered for all the student, it benefits only those students from urban settlement."*

The above excerpts serve as an eye-opener to the facts that some of the student-teachers benefit little or nothing from the curriculum. The implementation style of some lecturers only favours those who are good academically, while those from under-resourced school were left out. Student-teachers are not equally endowed cognitively, hence the need to introduce innovation and varieties of implementation strategies to ensure that all the student-teachers are caterered for.

Theme four: **Students' reflection on time allotted for the life skill modules**
Time for both curriculum implementation and student-teachers' reflection on the curriculum and their learning is not enough:

The time allotted to the module is not enough because there was part of the module the student-teachers are expected to complete on their own, just because there is no time; And how are we sure we have done the right thing without lecturers' guide"

On this point, a participant opposed her colleagues view by saying that some of the student-teachers are not punctual in the class hence, they missed a good aspect of the lecture.

"I think we are given enough time, the problem is that some student-teachers absent themselves from classes".

The foundation phase life skill module syllabus is not usually completed due to insufficient allotted to it. Certain contents that are sometimes useful are left unattended to, especially if the contents are towards the end of the semester why some of the contents are left for student-teachers to cover on their own. They opined that certain redundant contents be removed from the syllabus to enable them to concentrate on contents that will lead to the achievement of their learning goals.

Theme five: **Student-teachers' experience of Assessment task, feedback and curriculum alignment**

The participants commended the lecturers for aligning the assessment task with the life skill contents. Virtually all the participants of this study agreed that there was an alignment of the life skill curriculum.

The assessment task aligns with the content as well as the criteria also teaching and learning activities are guided by the specified assessment because assessment is given links directly with the learning and teaching."

However, few of the student-teachers declared that assessment feedback is neither clear nor consistently given:

Absolutely, the assessment tasks are always in line with the content, but the assessment feedback not clear or understood by all."

And:

"Sometimes they don't give feedback neither do they explain to us reasons for our scores."

A student spoke with intense feeling:

"But I think is better they give us feedback on what we did so that our mistake will not be repeated. Another big challenge of assessment feedback is that what a lecturer condemned may be accepted by others and this leads to confusion, I wish we are involved in our assessment."

The above reports from student-teachers' shows that the lecturers gave more written feedback on assessment than oral of which some of the student-teachers do not take time to read and few that read are not comprehending the assessment comments. Feedback should be taken seriously to enable them to see and rectify their mistakes. Also, assessment feedback should be read to the class, explaining to the student-teachers how they came about the marks they scored as well as any weaknesses - which would be better for student-teachers.

DISCUSSION OF FINDINGS

The above-stated responses on student-teachers' experiences of the curriculum suggest a gap in foundation phase curriculum that needed to be improved upon. Maxine Greene (2010), a human rights activist and an educationist, stated that we are dealing with dynamic and increasing changing society, ideas, and people. Hence, it becomes imperative for schools to move along and explore any available opportunity to visualize and design education that builds on the lifestyles and interests of the student-teachers. Effective curriculum implementation implies that curriculum implementer coherently aligned curriculum components during teaching and learning activities to support student-teachers to achieve the set learning outcome (Biggs 2014, Akker, 2009).

However, from the study, we observed that the participants of this study felt dissatisfied and unfulfilled with the implementation strategies of the foundation phase life skill curriculum. The student-teachers complained about the incoherence in the content learned at the university and the content they were expected to teach foundation phase learners. These findings agree with the results of Mooi (2010), Hennemann and Liefner (2010), as well as Rasul and Mansor (2013) that reported that university graduates are not well equipped for their careers as there exists a gap between the skills acquired in schools and globally required skills. Hence, the participants in this study are requesting for improvement of all the

components of the curriculum as stated by Akker (2009) in his concept of curriculum spider web.

Another vital point from finding is the method of copying from the module into slides to be read to the student-teachers by some of the lecturers which do not benefit many of the participants, especially those from a disadvantaged background. This finding refuted the idea of Biggs (2014) that advocated that student should be guided to construct their learning and not to be indoctrinated. Issues on assessment were raised, findings show that lecturers gave more written feedback than oral of which is not comprehended by the student-teachers. This point resonated with some scholars that stated that assessment is having a deleterious effect on learning and is not providing a sound basis for learning beyond graduation (Richardson, Alden Rivers, & Whitelock, 2015; Fry, Ketteridge & Marshalls, 2009).

CONCLUSION AND RECOMMENDATIONS

The above-stated responses from the participants of this study suggest a gap in foundation phase Life Skill curriculum that needed to be improved upon. However, the students commented that the lecturers have the content knowledge of Life Skill curriculum but for the implementation strategies. The student teachers felt unfulfilled and unsatisfied with the training received. Therefore, the study recommended that empowerments programme be organized for the teacher-educators to improve on their implementation strategies, and make selection of contents applicable to Foundation Phase learners and the student-teachers' needs. In addition, teaching and learning activities should be enhanced by including a variety of teaching aids such as cinematographic (movies, films, etc.), pictorial (moveable pictures), and acoustic resources (listening activities) to make teaching and learning appealing to student-teachers. Lastly, student-teachers are to be encouraged to take an active part in their learning so that they can acquire critical thinking skills.

REFERENCES

Agabi, C. O., & Ogah, J. I. (2010). Education and human resource planning in Nigeria: the case of the National Manpower Board (NMB). *International Journal of Scientific Research in Education*, *3*(3), 152-165.

Amory, A. (2010). Education technology and hidden ideological contradictions. *Journal of Educational Technology & Society*, *13*(1), 69.

Aregbeyen, O. (2010). Student-teachers' perceptions of effective teaching and effective lecturer characteristics at the University of Ibadan, Nigeria. *Pakistan Journal of Social Sciences*, *7*(2), 62-69.

Atjonen, P. (2014). Teachers' views of their assessment practice. *Curriculum Journal*, *25*(2), 238-259.

Bantwini, B. D. (2010). How teachers perceive the new curriculum reform: Lessons from a school district in the Eastern Cape Province, South Africa. *International journal of educational development*, *30*(1), 83-90.

Biggs, J. (2014). Aligning teaching and assessing to course objectives. *Teaching and learning in higher education: New trends and innovations*, *2*, 13-17.

Brooman, S., Darwent, S., & Pimor, A. (2015). The student voice in higher education curriculum design: is there value in listening? *Innovations in Education and Teaching International*, *52*(6), 663-674.

Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th Ed.). Milton Park: Routledge Falmer.

Crosby, R. H. J. (2000). AMEE Guide No 20: The good teacher is more than a lecturer-the twelve roles of the teacher. *Medical Teacher*, *22*(4), 334-347.

Darling-Hammond, L. (2012). One piece of the whole: Teacher evaluation as part of a comprehensive system for teaching and learning. *American Educator*, *38*(1), 4.

Eisner, E. (1985). Five basic orientations to the curriculum. *The educational imagination*, 61-86.

Elizondo-Montemayor, L., Hernández-Escobar, C., Ayala-Aguirre, F., & Aguilar, G. M. (2008). Building a sense of ownership to facilitate change: The new curriculum. *International Journal of Leadership in Education*, 11(1), 83-102.

Greene, M. (2010). Teaching in a moment of crisis: The spaces of imagination. *The New Educator*, *1*(2), 77-80.

Hennemann, S., & Liefner, I. (2010). Employability of German geography graduates: The mismatch between knowledge acquired and competencies required. *Journal of Geography in Higher Education*, *34*(2), 215-230.

Joseph, S. (2013). The impact of differentiated instruction in a teacher education setting: Successes and challenges. *International Journal of Higher Education*, 2(3), 28-40.

Khoza, S. B. (2012). Who helps an online facilitator to learn with student-teachers in a day? *Mevlana International Journal of Education, 2*(2), 75-84.

Mooi, L. M. (2010). Teacher education: innovative, effectiveness and global. *Procedia-Social and Behavioral Sciences*, *9*, 1815-1820.

Mkhwanazi, H.N. (2014). *Teachers' use of formative assessment in the teaching of reading comprehension in Grade 3*. (Ph.D. Thesis, University of Pretoria). Retrieved on 20/05/2016 from http://hdl.net/2263/40237.

Nakpodia, E. D. (2013). Techniques for improving private sector participation in the funding of educational institutions in Delta State, Nigeria. *International Journal of Sociology and Anthropology*, *5*(4), 133.

Ogude, N., Nel, H., & Oosthuizen, M. (2005). The challenge of curriculum responsiveness in South African higher education. *Council on Higher Education*.

Prajapati, R. K., Sharma, B., & Sharma, D. (2017). The Significance of Life Skills Education. *Contemporary Issues in Education Research*, *10*(1), 1-6.

Perez. J (2015), Align Your Curriculum and Save Your Student-teachers. St Thomas University online. Retrieved on 20/06/2017 from http://www.hotchalkeducationnetwork.com/curriculum-alignment-matters.

Rasul, M. S., & Mansor, A. N. (2013). Employability skills indicator as perceived by manufacturing employers. *Asian Social Science*, *9*(8), 42.

Sindhu, I.S. (2012). Educational Administration and Management. New Delhi India: Dorling Kindersley (India) Pvt. Ltd.

Richardson, J. T., Alden Rivers, B., & Whitelock, D. (2015). The role of feedback in the under-attainment of ethnic minority student-teachers: evidence from distance education. *Assessment & Evaluation in Higher Education*, *40*(4), 557-573.

Smardon, D., & Bewley, S. (2007, September). What student-teachers say about their learning-how can this improve learning? In *Paper presented at the British Educational Research Association Annual Conference* (Vol. 5, p. 8).

Su, F., & Wood, M. (2012). What makes a good university lecturer? Student-teachers' perceptions of teaching excellence. *Journal of Applied Research in Higher Education*, *4*(2), 142-155.

Tangwa, G. B. (2009). Ethical principles in health research and review process. *Acta tropica*, *112*, S2-S7.

Waldrip, B. G., Fisher, D. L., & Dorman, J. P. (2008). Student-teachers' perceptions of assessment process: questionnaire. In *Proceedings of the 5th International Conference on Science, Mathematics and Technology Education 2008* (pp. 561-568). Curtin University of Technology.

Wellman, H. M., & Gelman, S. A. (1992). Cognitive development: Foundational theories of core domains. *Annual review of psychology*, *43*(1), 337-375.

Whitelock, D. (2010, July). Activating assessment for learning: Are we on the way to Web 2.0. In *Web* (Vol. 2, pp. 319-342).

Yorke, M. 2001. Formative assessment and its relevance to retention. Higher Education Research and Development 20(2):115-126.

TECHNOLOGY TEACHERS' CHALLENGES IN TEACHING SYSTEMS AND CONTROL IN GRADE 7 CLASSROOM

E. C. Ndlovu & M. T. Gumbo
University of South Africa
E-mail: ndlovec@unisa.ac.za; gumbomt@unisa.ac.za

Abstract

Technology Education (TE) aims at enhancing technological literacy. It helps learners to develop specific skills to solve problems. According to the National Curriculum Statement (NCS) and now Curriculum and Assessment Policy Statement (CAPS), systems and control requires an understanding of operation of systems. The purpose of this study was to investigate Grade 7 teachers' challenges in teaching systems and control. The study used a case study design. Four Technology teachers were purposively selected because they had experienced challenges in teaching systems and control. An open-ended interview schedule was used to collect data. The study revealed challenges such as inadequate training, lack of TE qualifications, ill-equipped laboratories, insufficient in-service courses and support from the department of education. Mechanical and electrical systems were identified as the most challenging concepts to teach. The study recommends in-service courses for Technology teachers and the provision of the necessary resources for TE.

Keywords: Challenges, systems and control, technology education

Introduction

Teaching is considered as a range of duties performed by teachers to promote learning. One of the duties of teachers is to employ effective teaching and learning strategies. Teachers should be able to fulfill various duties outlined in the Norms and Standards for Teachers, which include being mediators of learning, interpreters and designers of learning programmes among (Department of Education, 2003). To be effective, teachers should be able to motivate and encourage learners to learn, have adequate knowledge of content and sound pedagogical skills (Commission on Teacher Credentialing, 2013).

Technology has existed throughout history. People combine knowledge, skills and available

resources to develop solutions that meet their daily needs and wants. The South African national curriculum delineates technology as the use of knowledge, skills and resources to meet people's needs and wants by developing practical solutions to problems whilst taking into consideration the social and environmental factors (Department of Education, 2011). The purpose of TE is to enhance technological literacy by helping learners to develop and apply specific skills to solve technological problems; understand the concepts and knowledge used in TE and use them creatively, and appreciate the interaction between people's values and attitudes, technology, society and the environment. TE has three specific learning aims (SLAs). In their brief format, these SLA are (1) technological processes and skills, (2) technological knowledge and understanding, and (3) the interrelationship between technology, society and the environment. Their focused aspects are investigating, designing, making, evaluating and communicating solutions (SLA 1); structures, processing, and systems and control and electricity and electronics (SLA 2); indigenous technology and culture, impact of technology and biases created by technology (SLA 3).

This study focuses on systems and control for SLA 2. According to the NCS and CAPS, a system is made up of interlinked parts that function together to accomplish a goal (Department of Education, 2003; Department of Basic Education, 2011). For example, a mechanical system is a combination of mechanisms that make it function as a whole. Control on the other hand is the means by which a system is regulated and adjusted to the process which makes the actual results conform more closely to the desired result. The content area of systems and control is divided into mechanical systems and electrical systems. Mechanical systems include hydraulic and pneumatic systems. Electrical systems are not taught in Grade 7. Systems and control requires a demonstration of knowledge and understanding of the operation of mechanical systems which change the direction of movement using the components and forces. This is represented in systems diagrams. However, some Technology teachers are still faced with many challenges towards teaching systems and control in Grade 7 (Korman & Simonian, 2010; Ndlovu & Olakanmi, 2017). Hence, this paper focuses at the investigation of the challenges facing teachers in the teaching of Grade 7 systems and control in X Secondary School at Rakwadu Circuit of Limpopo, South Africa. Translating to the research question: *how do grade 7 technology teachers at X secondary school deal with challenges faced in teaching systems and control?* The following objectives guided the study: 1) To find out the challenges facing Technology teachers in teaching systems and control, and

2) To determine ways in which these challenges can be addressed.

Literature review

Technology is the use of knowledge, skills and different materials to meet human needs and wants and to recognise and solve problems by investigating, designing and evaluating processes and systems (Department of Basic Education, 2010). It is a process that uses knowledge, skills and resources to meet human needs and wants by designing, making and evaluating products, processes and systems (Pudi, 2005). TE, is concerned with technological knowledge, skills and processes and involves understanding the impact of technology on both the individual and society. TE, is ultimately designed to promote the capability of learners to perform effectively in their technological environments and to stimulate them to contribute towards its improvement. According to an overview document (Department of Basic Education, 2010), technology has existed throughout history as an activity in which people use a blend of knowledge. Studies investigating the challenges of Technology teachers in teaching the subject Technology have been carried out and reported by a number of investigators highlighting the need for the development of skills by teachers undergoing training so that they could be able to use a wide variety of instructional materials efficiently (Krajcik, Blumenfeld, Marx & Soloway, 1994; Mishra & Koehler, 2006; Mapotse, 2017). According to Engelbrecht (2006:1008), the body of literature is growing regarding the challenges that teachers come across towards teaching subjects such as TE more especially with regard to the teaching of systems and control. As a results there is a need for support structures to support teachers. Johnson (2006) concurs that learners' poor performance can be attributed to the ineffective ways of teaching systems and control. Lack of knowledge of conceptual issues by teachers results in their having difficulties in internalising the procedures. The performance of learners is affected by how teachers teach the concepts of TE because most teachers lack knowledge, skills and training in the conceptual functions (Davidoff and Lazarus (1997; Pule, 2017). According to Pudi (2005), who researched the challenges of Technology teachers in teaching systems and control theme in class, there should be an ongoing research on the challenges of Technology teachers in schools. He pointed out that on-going investigations should be geared towards teacher motivation and appreciation of technology procedures and skills, critical and creative thinking. TE should also be presented using a problem solving, pluralistic and interdisciplinary approach. The methodologies used to attain knowledge, skills and attitude outcomes should be progressive,

integrated and holistic. The outcomes should provide progression and be differentiated according to the varying levels of general orientation, self-critical exercises, design and evaluation projects. Continuous assessment strategies should be applied to ascertain whether the outcomes have been achieved in an individual or a group.

Theoretical framework

Shulman's (1987) framework ground this study towards understanding, how technology teachers in Grade seven (7) at Rakwadu circuit of Limpopo province deal with the challenges of teaching systems and control. Teacher's content knowledge plays a very important role in the teaching of systems and control. Shulman catergorise teacher knowledge into three, as curricular content knowledge, subject matter content knowledge and pedagogical content knowledge. According to Shulman, curricular content knowledge involves knowledge and familiarity with the available tools for instruction. Subject matter content knowledge refers to the amount and organisation of subject knowledge in the mind of the teacher. This includes not only the factual information of the subject, but also an awareness of the nature of the knowledge, how elements in the subject are built up and linked together, criteria for what is recognised as valid knowledge in the subject and how new knowledge is constructed. Pedagogical content knowledge represents the particular aspect of a teacher's content knowledge that relate to how the knowledge of subject matter can be presented in teaching. Pedagogical content knowledge also includes the identification and understanding of the important ideas and skills in the subject. The teacher should understand the subject content. This involves the availability of teaching and learning tools. Teachers need knowledge and strategies on how to transform content into instruction that makes it comprehensible to the learners (Shulman, 1987).

Teachers should realign their technological skills and methodologies to achieve set goals. They should also encourage the involvement of learners in the teaching and learning activities to improve their performance. The success of TE, especially systems and control, depends to a large extent on the teacher. The teacher should make the lessons more desirable and stimulating especially when he/she does practical work to motivate the learners. Learners' positive attitudes generate interest in the lesson (Kazeni & Onwu, 2013; Roth, 2013). Scwab (1994) proposes a particular aspect of teachers' content knowledge that relates to how the knowledge of systems and control can be presented in teaching. Teachers need

knowledge and strategies on how to transform the subject matter of systems and control into instructions that make it comprehensible to the learners. This includes the knowledge and choice of powerful learning activities, demonstrations and examples as well as consciousness of preconceptions and misconceptions that are frequently held by learners and strategies to reorganise these activities. The content area of systems and control is divided into mechanical systems, which include hydraulic, pneumatic and electrical systems. The study of mechanical systems focuses on producing movements in some way, and examines how energy sources can be used to power products to produce movements. In the higher grades, the learner should engage with the concept of mechanical advantage and how mechanical systems are used to achieve suitable speeds, forces or drive ratios. The study of electrical systems focuses on the practical use of electrical energy in circuits to satisfy specific needs. Electronics, covered at the higher levels, is seen as closely related to electrical circuits but deals more closely with low current signaling and sensing (Department of Basic Education, 2010). The learner explores the system and control content area through context like transport, lighting, household devices and simple machines. Learning about control systems design and implementation using real equipment is one of the most challenging but useful ways to learn about control systems. The practical processes have features that cannot be learned theoretically in a textbook only (Korman & Simonian, 2010). In systems and control, the teacher and learner should explore mechanisms that involve mechanical advantages and change in function and movement. The components of these mechanical systems include cams, pistons, pulleys, pivot and slider, eccentric wheels, cranks, livers, linked livers and so on. Practical tests with variations on size, length and position of the components contribute to knowledge development. By practical experimentation, the learner should develop understanding of the operation difference of the output when connected differently. Where possible, the learner should engage in projects that integrate processing structures and systems and control (Department of Basic Education, 2010).

Because of its practical nature, the systems and control curriculum should be anchored on social constructivist principles to develop conceptual understanding, fluency and problem-solving skills in a manner that makes these attributes mutually supportive. In the constructivist approach, instruction is a process that supports knowledge construction rather than communicating that knowledge to passive learners (Nawaz, 2012). The teacher serves as a guide, rather than as an expert who transfers knowledge to learners. Learning activities are

authentic and leverage the learners' puzzlement and curiosity that arise when their faulty or incomplete knowledge fails to predict what they observe. Teachers encourage learners to reflect on these experiences, seek alternative viewpoints, and test a variety of ideas. Learner motivation to achieve these goals is determined by factors such as challenge, curiosity, choice, fantasy, and social recognition (Fox-Turnbull & Snape, 2011). The South African National Research Council lists the essential goals of learning in a constructivist approach as building a deep foundation of factual knowledge and procedural skills; developing conceptual frameworks; organising the domain knowledge as experts do; and improving the thinking processes. Learner motivation to achieve these goals is determined by a variety of intrinsic and extrinsic factors, such as satisfaction from achievement, challenge and curiosity. From the foregoing, it was apparent that the teaching of systems and control in TE is beset with chains of problems, which require redress. This leaves a gap between the values, principles and vision stipulated in the South African CAPS document.

Research methodology

Research design

This was a qualitative case study design concerned with individuals' world views and belief systems. The qualitative research approach was chosen because it offers opportunities for the exploration and deeper explanation of the participants' views about the teaching of systems and control (Creswell, 2012). Belzer (2005) asserts that qualitative methods can be used to understand phenomena about which little is known, or to gain more-in-depth information that may be difficult to convey quantitatively.

Sampling and Sampling techniques

Four Technology teachers were purposively sampled. The teachers were suitable for this study because they were directly involved in teaching Technology and were experiencing educational challenges. Purposive sampling is a generic term used to describe any sample which is deliberately chosen by the researcher in accordance with predetermined non-probability criteria (Creswell, 2012). The purpose of using this sampling procedure was to obtain the richest possible source of information to address the research objectives.

Instruments

An open-ended interview guide was used to collect data from the teachers. Unstructured interviews were used because they were essentially qualitative, phenomenological oriented data collection methods; they enabled explanatory discussions that allowed the researcher not only to understand the "what" and the "how", but also to grasp and explore the internal dynamics of the research topic. Inter-rater reliability was conducted on this study by having an educational professional and school management team (SMT) with extensive knowledge of systems and control to independently scrutinise the instruments (Jackson, 2004). Ethical issues were considered. For instance, the participants were informed about the interviews and they consented, volunteered to participate and had the right to withdraw without penalty. The participants were anonymised and promised confidentiality during the reporting of the findings.

The participants were encouraged and allowed to feel free in expressing their views without fear; as they were promised confidentiality and anonymity during the reporting of the findings. Each teacher participated in a 60 minute interview on systems and control. A questionnaire was then distributed to the teachers who completed them within ten minutes. The questionnaire consisted of closed and open ended questions. Data were coded and segmented. Patterns of the challenges that teachers faced were formed. Data were then triangulated across the participants as sources of data to ensure trustworthiness.

Findings

All the Technology teachers had no TE related qualifications. They only had primary school qualifications. This implies that they were assigned to teach a subject which they did not train for. It is obvious that they were ill-equipped with the requisite background knowledge to teach systems and control. This explains why the teachers had challenges in teaching systems and control. Since they had no higher qualifications, it is imperative that they get further training in TE. This finding is in agreement with that of Archibugia and Pietrobelli (2003), which recommended that global technological training is necessary for the effective performance of teachers and technology transfer. Johnson (2006) and Davidoff & Lazarus (1997) concur that lack of relevant training poses challenges to teachers and negatively affects the performance of both the learners and teachers.

Two of the teachers had worked for a period ranging between 6 to 10 years whereas the other

two had worked for less than five years. This implies that for the years they had worked, they had specialised in the teaching of their traditional subjects; hence the introduction of a new subject posed a major challenge to them. However, their years of experience could have been advantageous if they were exposed to TE and they would have been more effective, had they been trained in TE. Kane, Rockoff & Staiger (2013) concur that experience of teachers leads to effectiveness; the more experienced they are, the more effective they become. Goldstein (2013) also agrees that there is a steady improvement in teacher effectiveness beginning from the fifth year of service onwards.

It is apparent that none of the teachers had any professional qualification in TE. Subject specialisation of the teachers who taught Technology at the school were in Mathematics (one teacher), Social Science (two teachers), and Natural Science (one teacher). Although science subjects may be inter-related, their methodologies, content philosophies and intents are different, hence, the need for the relevant specialisation. The teachers therefore faced challenges in teaching a subject that they were not trained to teach. Also, all of the respondents had never had in-service training in TE. This is in agreement with the finding of Johnson (2006) who recommends that teachers need to be adequately trained in order to perform effectively.

Lack of teaching materials was identified as a key problem mitigating against the successful implementation of TE. Three teachers had textbooks and only one had laboratory equipment. TE is a practical subject that requires the use of a laboratory equipped with teaching aids to make it meaningful to learners. It shows that there are more textbooks than the laboratory equipment for practical work. While textbooks are essential for the theoretical aspects of a practical subject like TE, laboratory equipment is more needed to engage the learners actively in authentic tasks. The subject is practical in nature and cannot be adequately taught theoretically. This finding concurs with that of Carrasco and Torrecilla (2012) who posit that one of the greatest challenges facing education is lack of materials to help teachers cope with learners' and curriculum demands. Abrahams and Millar (2008) also agree that lack of resources for teaching and learning is detrimental to learning.

When asked to state the problems they faced in teaching Technology, responses received indicate that all four teachers experienced difficulties when interpreting the syntax of

terminologies used in the TE textbooks. This is in agreement with Fakeye's (2012) finding that teacher competence in classroom procedures contribute more to teachers' abilities to infer learners' self-concept thereby performance. Since the teachers did not comprehend the terminologies in the subject, they were bound to have problems teaching the same and were therefore ineffective. Fakeye (2012) found that teacher's qualification and subject mastery could be a predictor of learners' achievement in the English language among senior secondary learners. Also, regarding interventions made by the government in terms of hiring services, workshops and training do not cover the expected competency needs to address the problems faced by Technology teachers within their respective classrooms. Below is a summary of verbatim responses from the respondents:

"…*I have attended several workshops organized Department of Education. These workshops were about lesson plans and continuous assessment. They didn't train us how to teach the lesson especially with the sections of systems and control…*".

"…*I do get some support, but not enough…there is integrated quality management system compromising of three programmes for enhancement and monitoring of performance in education system, with different focus and purpose. The tool seems less effective as we experience break of education on the part of the government due to lack of human resources…*".

Asked about specific challenges they experienced during the actual teaching of systems and control, all the teachers responded that both mechanical and electrical systems were challenging to teach because as a teacher, one needs to understand how these systems differ from each other and how they relate with each other. They lacked this foreknowledge. They had a problem in identifying the different components of mechanical and electrical parts and how to assemble them to form a system. Korman and Simonian (2010) agree that the coordination of mechanical, electrical and plumbing systems has become a major challenge for project delivery teams.

One of the respondents explained:

"…*mechanical systems and electrical systems are challenging to teach because a*

teacher needs to understand how these systems differ from each other and how they can relate with each other. The interrelationship between mechanical and electrical systems should be seen as relatives because most mechanical systems can be turn into electrical or electrical to mechanical. They should be dealt both theoretically and practically…".

In concurrence, another respondent said:

"…The challenge is how these systems acquire, store and release energy, how this energy is used. One should understand that in mechanical system the energy released is always kinetic without having to be potential but in electrical systems there is stored energy in the form of potential energy and when released is can change into mechanical energy…".

Another respondent added:

"…both mechanical and electrical systems are challenging to teach because as a teacher…It will take time to make a product that is safe to use by the learners during teaching. It is a quite challenging because the product will cost to make or to buy…".

When asked to suggest solutions to the challenges, all the respondents said that they lacked teaching resources and so there was a need to provide well equipped laboratories. In the laboratories, models of systems should be made available in schools, so that learners can experiment and build their own systems using different components and identify the types of systems and their purposes. This is in agreement with Hofstein's and Lunetta's (2003) finding that laboratory should be given a central and distinctive role in science education, that science teachers have suggested that rich benefits in learning accruing from laboratory activities. There was also a need for in-service training for the teachers. They explained that in order to overcome the challenges, there was a need for continuously upgrading their skills and content. A respondent observed:

"…the teacher needs more exposure in both systems and control and also need to be familiar to the components and their use. It is of utmost importance that the teacher knows how to assemble these components and form a system…".

Another respondent agreed:

"…*The teacher should learn more of the practically based activities than theory because all aspects in technology when it comes to systems there must be practical work. This calls for well-equipped laboratories…*".

Another equipped:

"… *It is a challenging experience to find myself in front of learners imparting knowledge activity to the learners about systems and control. We need to constantly upgrade our teaching methodologies and subject matter…*".

Conclusions and Recommendations

The study investigated challenges facing Technology teachers at X Secondary School. It found that there are several challenges faced by Technology teachers such as lack of adequate training or TE qualifications, lack of resources such as a well-equipped laboratory, insufficient in-service courses and support on teaching systems and control (Mapotse, 2017; Pule, 2017)). Mechanical and electric systems were considered difficult concepts to teach. It is recommended that the government provides requisite resources for TE and that all Technology teachers should be adequately trained through pre-service and in-service courses. A study that investigates government policy design and implementation regarding TE should be undertaken to assess if there is any mismatch in policy design and implementation.

References

Abrahams, I. & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. *International Journal of Science Education*, *30*, 1945-1969.

Archibugia, D. & Pietrobelli, C. (2003). The globalisation of technology and its implications for developing countries. *Windows of Opportunity or Further Burden? Technological Forecasting & Social Change, 70*, 861-883.

Belzer, A. (2005). Improving professional development systems: Recommendations from the Penrsylvania Adult Basic Education Literacy Education Professional Development

System Evaluation. *Adult Basic Education: An Interdisciplinary Journal for Adult Literacy Educational Planning, 15(*1), 33-35.

Carrasco, M.R. & Torrecilla, F.M.J. (2012). Learning environments with technological resources: A look at their contribution to student performance in Latin American Elementary Schools. Available at: https://link.springer.com/article/10.1007/s11423-012-9262-5. Accessed 6 July 2012.

Commission on Teacher Credentialing. (2013). Making subject matter comprehensible to students TPE 1: Specific pedagogical skills for subject matter instruct. Available at: http://www.ctc.ca.gov/educator-prep/ standards/adopted-TPEs-2013.pdf. Accessed 29 July 2018.

Creswell, J.W. (2012). *Qualitative inquiry and research design: Choosing among five approaches*. SAGE: Thousand Oaks.

Davidoff, S. & Lazarus, S. (1997). The learning school: Organization development approach. Juta: Cape Town.

Department of Education. (2003). *National Curriculum Statement Grades 10 – 12 (General) – Physical Sciences*. Government Printers: Pretoria.

Department of Basic Education. (2010). *National Strategy for Mathematics, Science and Technology Education in General and Further Education and Training*. Government Printers: Pretoria.

Department of Basic Education. (2011). *National Curriculum Statement: Curriculum and Assessment Policy Statement (CAPS).* Technology Grade 7-9. Pretoria: Government press.

Engelbrecht, P. (2006). The implementation of inclusive education in South Africa after ten years of democracy. *European Journal of Psychology in Education, XXI*, 253-264.

Fakeye, D.O. (2012). Teachers' qualification and subject mastery as predictors of achievement in English language in Ibarapapa Division of Oyo State. *Global Journal of Human Social Science, 12*(3), 1-7.

Fox-Turnbull, W. & Snape, P. (2011). Technology teacher education through a constructivist approach. *Design and Technology Education, 16*(2), 1-12.

Goldstein, D. (2013). TFA teachers perform well in a new study -- But teacher experience still matters. Available at: http://www.danagoldstein.net/dana_goldstein/2013/09/tfa-teachers-perform-well-in-a-new-study-but-teacher-experience-still-matters.html. Accessed 10 December 2013.

Hofstein, A. & Lunetta, V.N. (2003). The laboratory in science education: Foundations for the twenty-first century. *Science Education*, *88*(1), 28-54.

Jackson, M.P. (2004). Industrial relations. Routledge: New York.

Johnson, S.A. (2006). *The impart of education technology.* Routledge: New York.

Kane, T.J., Rockoff, J.E. & Staiger, D.O. (2013). What does certification tell us about teacher effectiveness? Evidence from New York City. *National Bureau of Economic Research*. Working Paper Series. Available at: http://www.nber.org/papers/w12155. Accessed 10 December 2013.

Kazeni, M. & Onwu, G. (2013). Comparative effectiveness of context-based and traditional approaches in teaching genetics: Student views and achievement. *African Journal of Research in Mathematics, Science and Technology Education*, *17*(1-2), 50-62.

Korman, T. & Simonian, L. (2010). AC 2010-23: Using Building Information Modelling to teach mechanical, electrical, and plumbing coordination. *American Society for Engineering Education*: California.

Krajcik, J.S., Blumenfeld, P.C., Marx, R.W. & Soloway, E. (1994). A collaborative model for helping middle grade science teachers learn project-based instruction. *The Elementary School Journal*, *94*(5), 483-497.

Mapotse, T.A. (2017). Development of a Technology Education cascading theory through community engagement site based support. *International Journal of Technology and Design Education, 28*: 685-699.

Mishra, P. & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Nawaz, A. (2012). An online social constructivist tool: A secondary school experience in the developing world. *Turkish Online Journal of Distance Education*, *12*(8), 1-9.

Ndlovu, E.C. & Olakanmi, E.E. (2017). Technology teachers' interpretation of the curriculum: a case study of South African schools. *Rethinking Education in the 21st Century, 2017 - aa-rf.org*. 78-88. http://aa-rf.org/wp-content/uploads/2018/08/SAICEd-2017-Proceedings.pdf#page=92

Pudi, T. (2005). *Critical and creative thinking skills in technology education. M ED, mini dissertation.* Rand Afrikaans University: Johannesburg.

Pule, S. (2017). Mixed media modelling of technological concepts in electricity. In P.J Williams & D. Barlex (Eds). *Contemporary research in Technology Education helping teachers develop research informed practice.* Springer: Singapore.

Roth, W.M. (2013). *What more in/for science education? An ethno methodological perspective*. Sense Publishers: Rotterdam.

Scwab, E.M. (1994). *Teacher perception for Technology. Unpublished doctoral thesis*. Wits University: Johannesburg.

Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-22.

EMPOWERING TECHNOLOGY EDUCATION TEACHERS IN LIMPOPO PROVINCE THROUGH BLENDED LEARNING: AN ODL COMMUNITY ENGAGEMENT CASE

Tomé Awshar Mapotse
University of South Africa

mapotta@unisa.ac.za

Abstract

The paper provides a broad framework for the post-service technology education (TE) teachers' development of specific strategic thrust of optimizing the affordances (benefits) around the theme mechanical systems and control so as to increase the effectiveness of TE teaching and learning. This ODL community engagement (CE) case was conducted with 13 post-serviced teachers using action research (AR) methodologies. In this continuous study, TE has find its way into school environment successfully and effectively through engaging post-serviced teachers who have a challenge in presenting some aspects of TE mechanical systems and control. The aim of this study was to empower TE teachers to take along their learners into a journey of hands-on and minds-on during the teachers' lesson presentation. This CE study was underpinned by technology education cascading theory. The researcher used reflective interviews, participant observation and photographs to collect data, which were subsequently coded and analysed. The results of the study indicate that teachers in Limpopo Province were confidence in presenting their TE lessons plans relating to mechanical systems under containerisation.

Keywords: blended learning; action research; technology cascading theory; educational living paradigm; technology education, open distance learning

INTRODUCTION

The 21st century learning has taken a turn to expose teachers to the blended mode of tuition. Most of the South African learners are exposed to contact mode of learning from tender age until they reach Grade 12 in their schooling system journey. It is only after Grade 12 that these learners are subjected to Open and Distance Learning (ODL). In most cases, the Technology Education (TE) teachers also form a cohort of the ODL students in most of the higher institutions of learning in the country. ODL practitioners are modelling Africa out of

chronic poverty by sustaining the teaching of Technology Education (TE) through Action Research (Mapotse, 2018a). In this study the following terms will be used interchangeably: TE teachers, pot-serviced teachers, co-researchers or participants. The most challenging situation is that the objective socio-economic conditions of Africa like poor infrastructure for teachers training, low per capita income, poor transport network and low population density drastically reduce access to conventional systems of education.

The destiny of Africa is in the hands of its own people whom the majority are technologically illiterate but doing their little bit of good to change their circumstances. Africans need to move the continent forward by taking it out of the economic quagmire it finds itself in (Mapotse, 2018a). This would be realised if the Education for All (EFA) movement that is a global commitment to provide quality education for all children, youth and adults could be supported the world over. It is difficult for the scholarship of distance education to keep pace with the delivery of Open and Distance Learning (ODL) due to all logistics that goes into this learning type. This is especially true given the vast increase and technological developments in (a) the definition of ODL (b) the formats of instruction and interaction (c) the entities who deliver it, and (d) the demographics of who receive it (Urtel, 2008). ODL has been purported as having a neutral effect on academic performance (Neuhauser, 2002) and at best, have a positive effect on students' achievement.

There is consensus that ODL course work have relatively high attrition rates as compared to face-to-face (F2F) course work (De Ture, 2004; Diaz, 2002; Morris, Wu & Finnegan, 2005; Neuhauser, 2002). Moreover, research that takes into account student demographic information (such as: age, class standing, gender, or race) in predicting who is more apt to excel in ODL is even more scarce. Norris and Conn (2005) report on the wide range of response rates of term-end course and instructor evaluations for the ODL delivery; these return rates range from zero to 95% of student participation. In addition, the base of research on end-of-term course and instructor evaluations for ODL course work is quite narrow. Since the study involves TE teachers, their targeted response rate was to empower them to engage their learners with more practicals in their teaching instructions. The aim of this study was to empower TE teachers to take along their learners into a journey of hands-on and minds-on during the teachers' lesson presentation.

After a reconnaissance study, before a full roll out, was conducted with few TE teachers from three different schools in Limpopo Province, the reconnaissance study findings reveal that the TE teachers have some challenges in teaching some themes within an academic year. The most challenging TE theme that confront these teachers is 'System and Control'. This theme houses the following sub-themes: 'Electrical and Electronic systems' as well as 'Mechanical Systems'. Many teachers in the continent on Africa especially in South Africa where the study is located do not have any qualification or they are underqualified to teach Technology, as most have been coerced to teach this subject. This study aims to answer the following research question: "How can an institutional blended tuition mode empower post-service teachers through CE to be confidence in their TE lesson presentation?"

BACKGROUND

Higher Education Transformation on ODL

Unisa is the only dedicated distance education institution in South Africa that is currently redefining and positioning itself as an ODL institution. In the year 2008 the ODL policy was developed which among other things stress that ODL (Unisa Open Distance Learning Policy, 2008:2). Is a multi-dimensional concept aimed at bridging the time, geographical, economic, social, educational and communication distance between student and institution, students and academics, student and courseware and student and peers. Open distance learning focuses on removing barriers in order to access learning, flexibility of learning provision, student-centeredness, supporting students and constructing learning programmes with the expectation that students can succeed.

ODL is characterised by a more diverse range of practices that still includes certain traditional print and correspondence models, but which also includes advance, developing, and online environments (Taylor, 2001). A central issue for ODL is students' learning of which the university has to demonstrate that learning do occur amidst the public discourses of economies of scale, students as clients and consumers and the marketization of education. Some of the co-researchers have registered with University of South Africa.

Literature Review: Identifying Gaps in the Previous Studies

The scholars in the fields of ODL have engaged in research targeting variety of aspects concerning ODL. For instance, Letseka (2015) researched and report on, 'Open Distance

Learning (ODL) in South Africa'. International Council for Open and Distance Education (ICDE) (2015) invested time in unpacking, 'Student Success in Open, Distance and E-learning'. Letseka (2016) efficaciously examined, 'Open Distance Learning through the Philosophy of Ubuntu'. Louw (2015) successfully investigated, 'The Design and Development of Curriculum in ODL'. Mudzielwana (2015) focuses the study in, 'The Role of Open Distance Learning in Promoting Higher Education'; whereas Ravhudzulo and Ndlangamandla (2015) took readers through research in, 'Practical and Critical Issues in Open Distance Learning'.

The afore mentioned scholars belonging to both national and global communities have used some common instruments or similar approaches to gather their data and little has been done in using Action Research (AR) approach as a means to TE through ODL in emerging nations. With this study the researcher, want to attempt to fill that gap by sharing experiences on how the Open and Distance Learning practitioners sustain the teaching of Technology Education through Action Research since the conventional systems are not in a position to intervene. This study has sought to identify and mitigate some of hegemonies of both ODL and contact tuition modes with TE teachers during community engagement (CE) project activities. Action Research is the systematic, reflective study of one's actions, and the effects of these actions, in a workplace context as depicted in Figure 1. As such, it involves deep inquiry into one's professional practice.
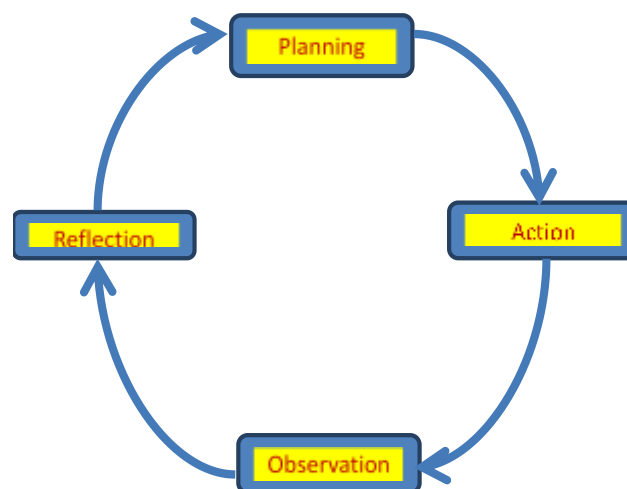

Figure 1: Action Research cycle. Source: Maseko (2005)

An emphasis was put on active learning through participation, as co-researchers are part of decision making throughout the process. Thus led to four AR cyclic process encompassing planning, action, observation and reflection. The researcher worked with the co-researchers throughout this research journey engaged in project making and assessment activities so that they can conscientise their learners a mechanical system project – a dustbin. Accordingly, assumption is made that engaging co-researchers (post-serviced TE teachers) in a technology education cascading theory (to be un packed in the ensuing section) would develop understanding of system and control theme and develop action competence, which led to finding solutions.

The team of a researcher and co-researchers examined their work and seek opportunities for improvement particularly in TE under the theme mechanical system with the subtopic 'Containerisation'. Technology Education (TE) has the possibility to offer a multitude of benefits for the developing countries from improving education and knowledge sharing, to increase exposure of an innovation to improving the living conditions of the developing countries' residents (Mapotse, 2018a). An AR practitioner/researcher will be sharing those Technology Education teachers' experiences as critical realists underpinning this study through technology education cascading theory. Hence, this study of TE through conventional systems of education will not be replicable since it uses AR approaches.

THEORETICAL FRAMEWORK

Theories are needed in this study to revel and unpack the research journey to be taken. The while theory is further desired to underpin the whole study.

Technology Education Cascading Theory underpins the study

The emancipation of the Technology teachers through technology education cascading theory was a viable option, given the need for them to develop a sense of their current knowledge and teaching of TE and how it could be cascaded within themselves as participants as well as to their leaners. Pihama (1993:40) wrote, "Cut off from practice, theory becomes simple verbalism, separated from theory, practice is nothing but blind activism". Mapotse (2018b: 02) support Pihama by stressing that TE in both minds-on and hands-on. Minds-on and hands-on in Technology must be taken to refer to learning-through-experiences, that is,

through practical engagement in the design/technological process. The design process steps are investigating, designing, making, evaluating and communicating ideas and plans (Department of Education [DoE], 2003). The participants were engaged in both the theory and practice in their teaching contexts. Theory was extrapolated from both the Technology policy and circuit work schedule on themes to be taught each term. Experiential learning is considered a powerful tool in ensuring meaningful learning in Technology in terms of combining theory and practice.

The researcher as an ODL practitioner manages to sustain the teaching of TE through AR in applying technology education cascading theory. The theory is anchored in the philosophy of 'each one, teach one' (Mapotse, 2017). In Year One the researcher was an AR practitioner and the three TE teachers from School 1 were the participants' served as co-researchers. In Year Two the researcher recruited and added a new school to the researcher's community engagement project. In short is that on yearly basis a new school is added to the project. Table 1 unpack the title changes of both the researcher and the AR participants on yearly bases.

Table 1: Symbolic structure of Technology Cascading Theory

Year of Community Engagement	Technology Education teachers as AR participants		
	School 1	School 2	School 3
Year One	3 participants		
Year Two	3 practitioners	4 participants	
Year Three	3 facilitators	4 practitioners	6 participants

This role changes alone makes all who are involved to change their titles annually, for instance, the researcher in Year One becomes an AR practitioner while the TE teachers serve as participants. In Year Two the researcher becomes the AR facilitator, School 1 TE teachers becomes AR practitioners while School 2 TE teachers become participants. Lastly as it is depicted on Table 1, in Year Three the researcher becomes a participant observer, TE teachers in School 1 becomes AR facilitators, those in School 2 becomes AR practitioners and the ones in School 3 come to the programme as participants. What is more crucial is that

in Year 1, the TE teachers are taken through AR process and in Year 2, they engage their peers from the other school with action learning activities.

RESEARCH METHODOLOGY

Research design and population of the study

The study uses qualitative research design. The study report on the journey travelled with TE teachers for three years. The population of the study increases annually as depicted on Table 1. The researcher started with three participants in Year One and end up with 13 participants in Year Three. The participants/co-researchers/TE teachers were added to the study on yearly basis. This study report about AR activities with 13 TE teachers in Limpopo Province.

Research methods and data analyses

The following methods were applied to collect data in this study: reflective interviews, participant observation and photographs. The co-researchers have to reflect and give account of the process of their learners making an artefact under the sub-theme 'containerisation'. Data collected was coded and analysed thematically based on the project facets provided.

RESEARCH RESULTS: COALESCING ODL RESEARCHER WITH F2F TE TEACHERS

The researcher from an ODL institutions and co-researchers did agree to give their learners a project that will depict 'System and Control', under mechanical systems. The project has to display 'Containerisation' of which the TE teachers agree to let their learners design a classroom bin to throw in all the fruit peels the learners from the fruits they were served during their lunch time. The teachers brought the trash bin projects made by learners from their respective schools during the contact session.

Success: workmanship, acquired skills and presentation or communication
i) Workmanship

In many schools, learners' workmanship seems to be a very serious challenge to both teachers and learners, and in this case, "learners did not trust each other especially when collecting materials. Some just relaxed". They "were arguing in doing the work. They were not working harmoniously with each other". Only one school had a positive report about workmanship:

"It was good based on the evidence of few groups that I did interview as an educator when they submit their projects. They indicated that they collectively and collaboratively worked together for a common course – their project".

Many of the teachers reported that their learners had not developed team spirit to achieve a specific goal. This had a direct bearing on the target date of submission.

ii) Skills acquired

Teachers' responses indicated that learners learned how to measure accurately. They could manipulate a combination of materials, hard and soft. They could design different types of dustbins. They also learned that some materials such as plastic, steel and wire, which are thrown away, could be recycled and make something more useful and attractive, even profitable if learners are supervised. The teachers also confirmed that their learners had acquired a variety of skills, such as how to make the structure stable; in some cases, it was the how of interpreting the project specifications; how to bend wires; how to cut cardboard to a required size, and so on.

iii) Aesthetics

Teachers were impressed with the learners' projects:

"Their products are attractive and beautiful. They look like real dustbins. The product is decorated with different colours".

I agree largely with the teachers' claim that the learners' realized designs were attractive, especially given the fact that this, according to the teachers, was their first attempt at engaging learners in a design project. One of them could be viewed from Photos: 1. and 2.

iv) Ergonomics

The teachers viewed the product as user-friendly because "the product is made of card box and edges are trimmed". However, one participant raised a concern about the learners' background, "more time is still needed to work on learners' efficiency, especially the Grade 8 learners. It seems that the learners never had a good or proper foundation on Technology project or research".

v) Duration

The Technology teachers gave the learners two weeks to design, complete and submit their projects. That was our agreement in the previous cycle. Nonetheless, learners' turnaround time differed from one school to another. At one school, one teacher responded, "my learners took a month and few days but only 70% of projects were submitted". Teachers responded further that majority of their learners showed commitment to their projects and were capable to deliver an envisaged project per grade. For this project in particular, resources were not an issue as learners' utilized recyclable material from their surroundings except those that reside in the school hostels.

vi) Team work

The learners were grouped mixed in gender of seven per group, but one teacher had this to say about the teamwork and the final product, "in the groups were female learners are dominant their project were colourfully decorated". One teacher responded that his learners took only three days to complete the project. I can only attribute that to strong teamwork and the type of project. "Team work was good", declared one teacher. "Team spirit was at 60% even though there were individuals, who were just spectators", another teacher contended.

DISCUSION OF FINDINGS

Project rollout by learners: duration, teamwork, capabilities, resources and assessment

Challenges: time and materials

Participants indicated that learners encountered an element of time constraint to an extent that the Technology teachers ended up being a little bit pushy. The responses indicated challenges encountered: some learners did not submit their project on time; others' measurements were incorrect; learners were not active enough to design the dustbins and/or test tubes containers; some learners used to leave their work at home; some were not participating. This did not come as a surprise because the teachers indicated that it was their first time that they experienced to engage their learners in project design and making. On the contrary, one teacher from one secondary school indicated:

> "It is difficult for learners to collect materials and tools which are expensive like glue, measuring tapes and electrical equipment".

Concerning materials, things went on well as learners used readily available materials from their surroundings. However, some teachers encountered challenges:

"Material also contributed too much too time consuming. Some groups took much time to come up with materials as they reside about six to eleven kilometres far apart from each other".

Grade 9 project under containerisation

The Grade 9 teachers had only one choice of a project for their learners. They came up with an indoor dustbin project. Photos 1 and photo 2 display a sample of the classroom dustbin project, which was constructed by Grade 9 from one secondary school.

Photo 1: A closed rubbish bin

Photo 2: An opened rubbish bin

This product is made out of wire and black refuse bag. The wire was used to construct the bin while the refuse bag material was used to wrap the wire. The bin also can be used as a teaching aid in addressing systems and control – mechanical systems – levers. The bin is opened by applying ones foot on the paddle so that internal mechanisms can open the lid.

Grade 8 project under containerisation

Photos 3 and 4 display the Grade 8 products under the theme 'Containerization'. These two artefacts are in their open mode. Photos 3 to 4 are a display of Grade 8 learners' sample of projects. The containers in both photos 3 and 4 promise to can transport nine (9) chemistry test tubes safely.

Photo 3: Test tube container form school 2   **Photo 4:** Test tube container from school 3

i) Duration

The Technology teachers gave the learners two weeks to design, complete and submit their projects. That was our agreement in the previous cycle. Nonetheless, learners' turnaround time differed from one school to another. At one school, one teacher responded, "my learners took a month and few days but only 70% of projects were submitted". Teachers responded further that majority of their learners showed commitment to their projects and were capable to deliver an envisaged project per grade. For this project in particular, resources were not an issue as learners' utilized recyclable material from their surroundings except those that reside in the school hostels.

ii) Team work

The learners were grouped mixed in gender of seven per group, but one teacher had this to say about the teamwork and the final product, "in the groups were female learners are dominant their project were colourfully decorated". One teacher responded that his learners took only three days to complete the project. I can only attribute that to strong teamwork and the type of project. "Team work was good", declared one teacher. "Team spirit was at 60% even though there were individuals, who were just spectators", another teacher contended.

iii) Capabilities and resources

It was realized that the project and the teams helped learners to talk to each other more often. The teachers also stressed that the fewer the members in a group the more manageable it was. Even though resources were not easily accessible to some, learners in both Grades (8 & 9) managed to use card box, glue, colours, spongy materials, wires and waste plastic bags.

iv) Project Assessment: peer (classmates and colleagues) and Technology teachers' assessment

The Technology teachers reported that by class and grade they could let learners display their finished projects and the learners engage in peer assessment. After this first round of assessment, the two best projects per class competed with the other best two from other classes, these being Technology teachers involving themselves in assessment. It was during this second round of assessment that the best two were brought forward to the contact session to represent their school. Peer assessment within each class was undertaken based on aesthetics and ergonomics, hence only the best two per category per grade were brought to the contact session.

CONCLUSION AND RECOMMENDATIONS

Technology Education (TE) teachers were empowered to teach the subject with confidence and every chance of success through action research spiral cycles. The TE teachers have been empowered to teach themes of Technology which they normally use to avoid in the past especially mechanical systems and control. The empowerment cycle programme with these post-serviced TE teachers followed the circuit themes as per their work-schedule. A rapport was established with TE teachers as the researcher moved from emic AR researcher to etic AR practitioner. As AR spiral and circular activities unfold, the role of teachers empowering each other on yearly basis surfaced in this community engagement project and the TE co-researchers were elevated to a new level of project leadership yearly. TE teachers of which most are studying on ODL mode were taken through contact sessions of AR activities.

Combination of ODL milieu and contact tuition mode can promote critical thinking and augment independent self-driven studying to enhance and change teaching and learning praxis of post-serviced TE teachers as evident on this study. It is important to note that this study does respond to the current critique of the hegemony of contact mode over ODL context, but intend to display how the two differ, complement and benefit the post-service TE teachers . The study holds the believe that this open distance learning community engagement case focuses on removing barriers to access learning, flexibility of learning provision, post-service teacher-centeredness, supporting TE teachers as AR co-researchers and who can construct learning programmes with the expectation that their learners can succeed. The study does not play down the contact mode, as it is the foundation where ODL is build.

It has been noticed that an ODL community engagement case can improve the incompetence of low self-esteemed TE teachers. The TE cascading theory together with the living paradigm manages to empower the 1st intake of TE teacher's cohort whom in turn where able to empower their fellow TE colleagues on yearly basis. At least for the first time TE teachers were able to let their learner display their innovation and creativity in constructing a mechanical systems and control projects, both the rubbish bins and test tube containers. I recommend that more studies and practical workshops be conducted on systems and control with TE teachers as this will be meaningful to the theory which their textbooks are outlining.

REFERENCES

Department of Education. (2003). Revised National Curriculum Statement Grade R-9 (schools). *Teacher's Guide for Developing Learning Programmes-Technology.* Retrieved from http://education.pwv.gov.za. Pretoria: Government Printers.

De Ture, M. (2004) Cognitive style and self-efficacy: Predicting student success in online distance education. The American Journal of Distance Education, 18(1), 21-38.

Diaz, D. P. (2002) Online drop rates revisited. The Technology Source Archives, retrieved December 10, 2007 from

http://technologysource.org/article/online_drop_rates_revisited/.

International Council for Open and Distance Education (ICDE). (2015). *Student Success in Open, Distance and E-learning*, report commissioned by the ICDE, Oslo, Norway.

Neuhauser, C. (2002). Learning style and effectiveness of online and face-to- face instruction. *The American Journal of Distance Education*, 16(2), 99-113.

Norris, J., & Conn, C. (2005). Investigating strategies for increasing student response rates to online-delivered course evaluations. The Quarterly Review of Distance Education, 61(1), 13-29.

Letseka, M. (ed). (2015). *Open Distance Learning (ODL) in South Africa*. New York: Nova Publishers.

Letseka, M. (ed). (2016). *Open Distance Learning (ODL) through the Philosophy of Ubuntu*. New York: Nova Publishers.

Louw, W. (2015). The Design and Development of Curriculum in ODL. In A. Ravhudzulo & S. Ndlangamandla (Eds), *Practical and Critical Issues in Open Distance Learning,* 29-38. Pretoria: Unisa Press.

Maseko, N. D. 2005. A life skills training workshop for class assistants who work in schools for learners with disabilities. Johannesburg: Rand Afrikaans University (MEd. Dissertation).

Mapotse, T. A. (2017). Development of a Technology Education Cascading Theory through community engagement site-based support. In *International Journal of Technology and Design Education*. DOI: 10.1007/s10798-017-9411-6, Netherlands: Springer.

Mapotse, T. A. (2018a). Open and Distance learning practitioners sustain the teaching of Technology Education through Action Learning. In U.C. Pandey and V. Indrakanti, (Eds.). *Open and Distance Learning for Sustainable Growth in Emerging Nations*. Sub-theme: Success stories of ODL institutions to build capacities of working professionals to apply Sustainable Development considerations in their work areas. IGI Global Publishers: USA.

Mapotse, T. A. (2018b). Technology Education professional development review through Community Engagement: an Action Research inquest. In T. A. Mapotse, (Ed.). *Cross-Disciplinary approaches to Action Research and Action Learning*. Sub-theme: Education. USA: IGI Global.

Morris, L.V., Wu, S. S. & Finnegan, C .L. (2005) Predicting retention in online general education courses. *The American Journal of Distance Education*, 19(1), 23-26.

Mudzielwana, N. P. (2015). The Role of Open Distance Learning in Promoting Higher Education. In A. Ravhudzulo & S. Ndlangamandla (Eds), *Practical and Critical Issues in Open Distance Learning,* 13-20. Pretoria: Unisa Press.

Pihama, L. (1996). Repositioning Maori Representation in Te Aratiatia Readings: Politics of Representation. Department of Maori Education, University of Auckland, 191-194.

Ravhudzulo, A. & Ndlangamandla, S. (Eds). (2015). *Practical and Critical Issues in Open Distance Learning*. Pretoria: Unisa Press.

Taylor, J. C. (2001). *Fifth generation distance education.* Keynote address delivered at the ICDE 20th World Conference, Dusseldorf, Germany, 1-5 April. Retrieved from www.irrodl.org/index.php/irrodl/rt/printerFriendly/65/133

Urtel, M. G. (2008). Assessing academic performance between traditional and distance education course formats. Educational Technology & Society

UNDERSTANDING GRADE 8 AND GRADE 9 MATH TEACHERS' MANIPULATION OF MATHEMATICAL LANGUAGE DURING LESSONS OF STORY PROBLEM COMPREHENSION1

Byung-In Seo2

University of South Africa

dr.bseo@gmail.com

Abstract

Mathematics is a written symbolic language. Its semiotics features have been well documented in mathematics, linguistic, and pedagogical studies. Similar to other languages, mathematical language is comprised of linguistic elements: symbols, nominalizations, and images. Before any changes can occur in mathematics teachers' pedagogy, it is necessary to understand how they write mathematically. Therefore, the goal of this study is to gain understanding of the teachers' use of the mathematical linguistic elements. For this study, a convenient sample of 37 math teachers from the North West Province, South Africa, participated in professional development workshops on problem solving methodologies. The teachers participated in two lessons that focused on the reading and writing of story problems. Using expressive linguistic teaching methods, these teachers learned how to translate text in story problems into equations, and they translated equations into text. Copies were made of all writing samples, which included notes during the two lessons and notes during the writing exercise. In addition, six teachers agreed to be interviewed about the lessons. All writing samples were coded according to their uses of symbols, nominalizations, and images. Results showed that the teachers incorporated the instruction from the lessons in their reading and writing exercises, manipulating their uses of symbols and images. In addition, the interviewees believed that these lessons will enhance their mathematical instruction in order to improve their students' critical reading and writing skills.

Keywords: Mathematical language, mathematics teachers, story problems, mathematical instruction

---

Introduction

In 2018, the South African Department of Basic Education wanted to have stricter guidelines on what it means for a learner to pass and proceed to the next grade. Currently, the pass rate is 30%, one of the lowest in the world (Staff Writer, 2018). In 2017, *The Economist* reported that in the Trends in International Mathematics and Science Study (TIMSS), South Africa is ranked near the bottom. In an effort to improve student learning in science, mathematics, engineering, and technology (STEM), universities and corporations across the country are providing professional development workshops for teachers. Each year, the University of South Africa (UNISA) sponsors a conference for math teachers to improve their pedagogy of problem solving skills to their students.

Much of the research on mathematical writing focuses on the students' abilities (Morgan, 1998; Pimm, 1995). There is little research that focuses on the teachers' abilities to manipulate mathematical language. In addition, most students in South Africa have had problems with deconstructing story problem text and reconstructing them into mathematical equations (Petersen, McAuliffe, & Vermeulen, 2017). Through a convenience sample of 37 grade 8 and grade 9 teachers, this study focused on their mathematical writing.

Conceptual Framework

Mathematics is a written symbolic language. Its semiotics features have been well documented in mathematics, linguistic, and pedagogical studies (Bullock, 1994; Landry, 1999; Planas, 2016; Raiker, 2002). Mathematical writing comes in different forms, depending on its function (Ernest, 2008a, 2008b; Seo, 2009). Primarily, it is a thematic condensation of mathematical terms, symbols, and images in order to convey mathematical knowledge and meaning. Thematic condensation is when "the whole implied activity can be qualified and related to other activities in a highly condensed manner" (Lemke, 1995, p. 60). An example of thematic condensation is in the equation $3y = 6$. For true understanding of this equation, the reader must understand the agreed upon meanings of the combination of symbols within mathematical ideas. This thematic condensation is the essence of mathematics. The three primary elements of this condensation are symbols, nominalization, and images.

Symbols are any mark on a surface. The meaning of that mark depends on its context. As the context changes so does the meaning (Harris, 1995; Rotman, 2000). For example ":" is two vertical dots. However, when it is used as a colon, it designates that a list will follow. If used as in "4:3," it designates a ratio. Symbols delegate complex cognitive tasks to an external environment (Van Dyck & Heeffer, 2014). Using ":" again as an example, ratio is a cognitive task. It is a thinking activity of comparing one value to another value. Before understanding what ":" means in a mathematical context, the reader must understand the concept and activity of ratios. Modern STEM relies of writing systems (Van Dyck & Heefer, 2014). Most people do not complete mathematical problems only in their mind. Symbols allow people the ability to convey these mathematical concepts and processes to others.

Nominalizations are words and acronyms that represent a complex mathematical process. Similar to equations, these words are "highly condensed" because one word required the understanding of more than one mathematical concept (Lemke, 1995, p. 60). For example, in Euclidian geometry, students are expected to know and be able to manipulate acronyms in proving theorems. "SSS Inequality" is Side-Side-Side Inequality, which is "if two sides of a triangle are congruent to two sides of another triangle, and the third side in one triangle is longer than the third side in the other, then the angle between the pair of congruent sides in the first triangle is greater than the corresponding angle in the second triangle" (Boyd, Cummins, Malloy, Carter, & Flores, 2005, p. 268). "SSS Inequality" is much easier to write than the complete definition. However, students need to understand the concept of SSS Inequality before they can use the nominalization. In Boyd et al. (2005), theorems are explained once, and then there are examples and practice problems using that theorem. If students do not understand the concept in that one explanation, then it is very difficult for them to understand the corresponding information.

In mathematics, images play an important part in conveying the meaning of text. Combined with symbols and nominalizations, they are often conventional, with little creativity (O'Halloran, 2008). For example, students are taught that in a two-dimensional Cartesian graph, there are the horizontal X-axis and the vertical Y-axis. The goal of an image is to link the reader to what is important in the text. As representatives of symbolic language, images can be misleading, even when there is an appearance of certainty (O'Halloran, 2008). Images are commonly seen in geometry. Geometric figures are seen as static, where no movement is

involved. These static figures are often used to represent all, i.e. circles and triangles, with specific details attached to them. While a letter can represent a variety of values, a picture of a triangle is just that, a triangle, not a variety of shapes (Pimm, 1995). Other commonly used images in grades 8 and 9 are diagrams and tables. In many cases, images are used as an organization tool, helping the student to discern which values relates to which idea.

Objectives of the Study

It is no secret that South African student mathematics performance is not competitive with other countries. Therefore, there is a need to improve their mathematical instruction. Instead of focusing on student learning practices, there is a push to focus on their teachers' pedagogical knowledge and skills. Because mathematics is a written language, students need to be able to write mathematically. However, before the students' learning changes, it is necessary to understand what their teachers know. For students to change, their teachers need to change first. Therefore, it is necessary to first understand how teachers write mathematically and how they use mathematical language. Once there is an awareness of how mathematics teachers use the language, then instructional methods can be developed to use strengths and further develop areas that need improvement.

The primary objective of this study is to understand how teachers from North West Province, South Africa, write mathematically. Focus was on their uses of symbols, nominalizations, and images.

Research Questions

How do the mathematics teachers from North West Province, South Africa, use mathematical elements in their writing?

Research Methods

Research Design: This study employed a qualitative design. The goal of qualitative research is to discover what the data will hold. In a qualitative design, there is often a hypothesis that needs to be proven. However, in a qualitative design, the goal is to uncover what people are thinking and feeling through their feedback (Miles, Huberman, & Saldaña, 2013). In this study, there were three different ways to gather the data, memoing, document analysis, and interviews. Memoing is when the researcher takes notes or memos during data collection.

Document analysis is a systematic way of analyzing documents, whether they are paper or electronic texts (Bowen, 2009). Interviews provided first-hand feedback on the teachers' experiences in the workshop lessons (Miles et al., 2013).

Instruments: For this study, memos were collected during the informal observations of the teachers during the lessons. In addition, notes were taken during the interview process. Post lessons, copies of the teachers' mathematical writing were made. In addition, six teachers (16.21%) participated in formal interviews (See Appendix A).

Reliable instruments collect the data as they are intended to do. In this study, the instruments are reliable because the collected data is valid (Miles et al., 2013). Informal observational notes were used to verify what the teachers wrote. For instance, when a teacher drew a diagram, she was asked why the diagram is necessary. By explaining that it helped her "sort my ideas," this participant validated the analysis process of the writing samples. Triangulation of the data occurred when the memos, writing samples, and interview responses led to the same analysis conclusion. More than one set of data was used to directly answer the research question. Each set approached the research objectives from a different angle (Miles et al., 2013). The researcher's approach is through the memos and notes. The teachers' approaches are through the copies of their writing samples and their interview responses.

Sample: All mathematics teachers from the North West Province were invited to a week-long professional development workshop. Of those invited, 44 teachers chose to participate in the workshops, but 37 completed the five-day sessions. This study focused on the participating teachers at the workshop. Therefore, this group of teachers is the result of convenience sample. Convenience sampling is when the study participants meet "practical criteria" such as location, accessibility, and availability (Etikan, Musa, & Alkassim, 2016, p. 2). Since the study's focus is on mathematics teachers, their gathering met the "practical criteria" of accessibility and availability. All teachers agreed to be part of the research studies that stemmed from these workshops. Thus, they were an accessible and available group of people.

Of this population, most of the participants were novice teachers (58.33%) with a Bachelor's degree (60%). Prior to these workshops, none of the teachers were aware of using expressive linguistics in the teaching of story problems.

Procedures: University of South Africa (UNISA) hosts a one-week professional development workshop for mathematics teachers. At the conference, a wide variety of topics are covered, from geoboards and trigonometry to probability and problem solving. Over the course of two professional development lessons, teachers from the North West Province, South Africa (n=37) were introduced to comprehension exercises of word problems. North West Province is rural, and these teachers' students come from farming communities.

Using expressive linguistic teaching methods, these teachers were taught how to translate text into equations, and they translated equations into text. Expressive linguistic teaching methods focus on identifying the diction, syntax, and lexicon of text. Once these expressive linguistic elements are identified, then literacy activities are constructed to teach these elements to the students (Fisher & Frey, 2016). Therefore, teachers need to be well versed in these elements in order to teach them to their students. During the UNISA conference, two lessons were focused on story problem comprehension. The first lesson focused on reading, and the second lesson focused on writing.

Lesson 1 was a reading lesson. The teachers focused on the grammatical structure of sentences, the introduction of words with mathematical meanings, and translating these words into mathematical equations (See Appendix B). During this lesson, teachers learned to use images as an organizational tool, to help them identify how and what the symbols are to represent. In addition, all of the word problem examples came from real-life situations.

Lesson 2 was a writing lesson. Teachers were put into groups of four to five teachers, and each group was given five equations (See Appendix C). The instruction was for them to write a story problem that incorporated the given equations. Participants were given flexibility in the topics of their stories provided that they incorporated the equations that were given to them. They were told to write the stories in a way that their students would understand the story itself and be able to derive the equations that were given to them.

Throughout the professional development sessions, there was an emphasis on making mathematics relevant to the students.

Upon completion of both lessons, copies were made of the teachers' notes from both the reading and writing lessons. In addition, teachers (n=6) were interviewed to get their feedback on the reading and writing lessons. Data was triangulated through the memos, coded writing samples, and coded interview transcripts.

Results

The writing exercise proved to be an effective assessment activity to the reading lesson. In all of the teachers' writing samples, the group rewrote the equation in a format that was more familiar to them. Once the teachers understood the meaning of the equations, they were able to design a story that incorporated it. Only symbols were used when they rewrote the equations. As taught in the reading lesson, teachers used images as an organizational tool, to help them understand the placement of the mathematical ideas. Teachers did not use nominalizations. All of the stories used non-mathematical vocabulary, incorporating the words that were taught in the previous lesson.

In Figure 1, Participant A first wrote "If Jack has 7 apples and Jill has 8 apples how many do they have." Then, underneath it, Participant A wrote another sentence, "Both Thabho and Thami have to sell 15 apple ~~per~~ in a day. If Thabho sold 9 apples how many does Thami have to sell." The names "Jack" and "Jill" are names commonly seen in American or Western European textbooks. By changing the names to "Thabho" and "Thami" and having them sell the apples, this teacher revised the story, so that the South African names and the behaviours common to their village are relevant to the students.

Figure 1: Example of Participant A's notes during the writing exercise

In Figure 2, Participant B used symbols when they rewriting the equations, for example "(6a-2)(a+12)". This story not only incorporated the mathematical equation, but it was also relevant to their students ("Two cows cost 5 dollars cows can").

Figure 2: Example of Participant B's notes during the writing exercise.

Teachers also used images to help organize their thoughts. In Figure 3, after factoring the trinomial, Participant C tried to make sense of it by graphing a parabola and drawing a 3 X 3 square. In addition, this person drew an inner rectangle and an outer rectangle. On the sides of both images, Participant C identified each side with the factors of the trinomial. During the informal observations, Participant C explained that the images were to help him organize the equations.
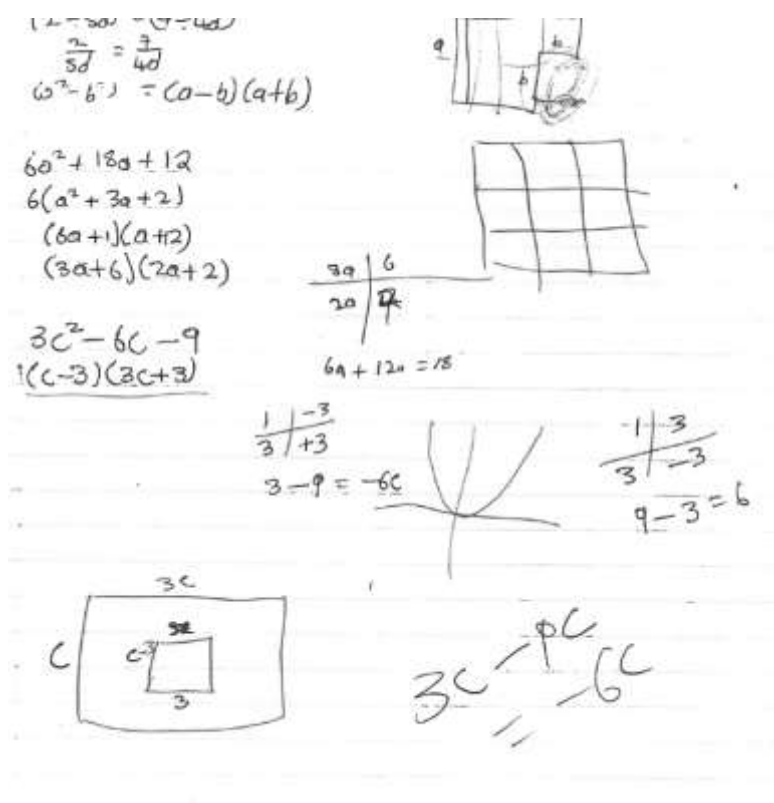
Figure 3: Example of Participant C's notes during the writing exercise

Of the 37 teachers, six teachers agreed to be interviewed. During the interview, they were asked for feedback on the workshops. When asked about the reading and writing lessons, everyone stated that it was a different way of approaching mathematical text, and everyone said that this different approach will be helpful to their own students. In addition, all of the interviewees stated that the writing exercise was more difficult. Interviewee 1 said that writing was not emphasized in mathematics class, and because they do not write often, it is easy to forget the essentials of writing. Interviewee 2's and Interviewee 4's initial reaction to

the reading lesson was of disbelief because they could not determine the applicability of this activity. However, as the lesson progressed, the expressive linguistics made more sense to them. Interviewee 3 initially thought that the writing exercise would be simple, but by incorporating real-life scenarios, it became more difficult. For all of their students, English is their second language.   While the other interviewees allude to this language difficulty, Interviewee 5 and Interviewee 6 specifically stated that the reading and writing exercises would be difficult for their students not because of the mathematical concepts but because English is not their first language.

Discussion of Findings

Mathematical semiotics is "unambiguously encoded in ways which involve maximal economy and condensation" (O'Halloran, 2008, p. 97). The economical encoding allows the symbols and mathematical functions to be manipulated in a way that different orders and placements still allows the mathematical problem to be solved and the meanings to emerge. This encoding is seen Figure 2 and Figure 3. In these examples, the teachers rearranged the given equations by factoring them. Once they had the factors, they had a better sense of how to write their stories.

Nobody used nominalizations in their writing, because there was no need for them. Everyone wrote word problems in simple English because English is not the first language of their students. In addition, there was no need to use highly condensed mathematical words.

Images were simple pictures to help organize the mathematical information. As O'Halloran (2008) stated, these images, combined with the symbols, were not very creative. They were either graphs or geometric pictures, and all of these images are used in conjunction with the symbolic language. In fact, all of the writing samples started with the symbolic language and drew images, as if the teachers needed another means of understanding the equations.

All of the teachers want mathematics to be accessible and relevant to their students. For the six interviewees, all of the lessons during the professional development workshop were helpful to them. Since English is the second language of their students, all of the teachers, either tacitly or overtly, stated that the mathematical processes were not the problem, but rather the English language of it.   While there may be concrete examples, mathematical

concepts are abstract. When students have difficulty comprehending the English language, grasping the mathematical concepts through English vocabulary words and symbols become more difficult (Molina, 2012). Throughout the workshops, teachers explained that an equivalent word in their home language did not always exist. As a result, the students are confused, and the teachers struggle to teach the mathematical concepts.

Prior to this workshop, none of them were exposed to expressive linguistic teaching methods. Using these methods provided a different perspective on the word problems that their students commonly encounter. In addition, the topics of the word problems can come from everyday occurrences, such as a percentage problem from a store invoice or a ratio problem from petrol prices. These teachers encountered a new way of looking at what they have been teaching for years.

Conclusion

During the literacy exercises, the teachers encountered issues that may be similar to their students'. They used symbols via equations as a method of encoding their mathematical thinking. In addition, their use of images showed their method of organizing the textual information. The interview data showed that the teachers were aware of the expressive linguistics and plan to bring similar lessons to their students. Since the teachers primarily used symbols and images, the probability of teaching their students the same uses are high. Teachers will use pedagogical methods that are familiar to them. Data showed that the teachers are most familiar with symbols and images.

In order for teachers to be more effective, they need to be able to manipulate all of the elements of mathematical writing. As teachers, it is their job to model, instruct, and assess their students' mathematical abilities. However, before any learning can take place, the teachers must have a firm grasp of not only the mathematical concepts but also the language that is used to explain and explore those concepts. In South Africa, all formal instruction needs to be conducted in English. The students and teachers in the North West Province do not use English as their first language. By writing their own story problems from a given equation, all of the teachers were reminded of some of the struggles their students encounter.

The idea of using expressive linguistic teaching methods does not occur in the mathematics classroom. Therefore, additional research needs to be conducted in order to verify these findings. However, it does provide a different way of approaching mathematically written texts in the teachers' routine instructions.

References

Bowen, G. A. (2009). Document analysis as a qualitative method. *Qualitative Research Journal, 9*(2), 27-40. doi: 10.3316/QRJ902027

Boyd, C. J., Cummins, J., Malloy, C., Carter, J., & Flores, A. (2005). *Geometry*. Chicago, IL, U.S.A.: McGraw Hill-Glencoe.

Bullock, J. O. (1994). Literacy in the language of mathematics. *The American Mathematical Monthly*, 101(8), 735-743.

Ernest, P. (2008a). Towards a mathematical text (Part 1). *For the Learning of Mathematics, 28*(1), 2-8.

Ernest, P. (2008b). Towards a mathematical text (Part 2). *For the Learning of Mathematics, 28*(2), 39-47.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposeful sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1-4.

Fisher, D., & Frey, N. (2016). *Improving adolescent literacy: Content area strategies at work* (4th ed). NY, U.S.A.: Pearson.

Harris, R. (1995). *Signs of writing*. NY, U.S.A.: Routledge.

Landry, E. (1999). Category theory: The language of mathematics. *Philosophy of Science, 66*(Proceedings), S14-S27.

Lemke, J. L. (1995). *Textual politics*. London, Great Britain: Taylor & Francis.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2013). *Qualitative data analysis*. Los Angeles, CA: Sage.

Molina, C. (2012). *The problem with math is English*. San Francisco, CA, U.S.A.: Jossey-Bass.

Morgan, C. (1998). *Writing mathematically*. London, Great Britain: Falmer Press.

O' Halloran, K. L. (2008). *Mathematical discourse: Language, symbolism, and visual images*. NY, U.S.A.: Continuum.

Petersen, B., McAuliffe, S., & Vermeulen, C. (2017). Writing and mathematical problem solving in Grade 3. *South African Journal of Childhood Education, 7*(1), a483. Retrieved from https:// doi.org/10.4102/sajce.v7i1.483

Pimm, D. (1995). *Symbols and meanings in school mathematics*. London, Great Britain: Routledge.

Planas, N. (2016). Research in mathematics, education and language. *PNA, 11*(1), 1-4.

Raiker, A. (2002). Spoken language and mathematics. Cambridge Journal of Education, 32(1), 45-60. doi: 10.1080/03057640220116427

Rotman, B. (2000). *Mathematics as sign*. Stanford, CA, U.S.A.: Stanford University Press.

Seo, B-I. (2009). Understanding the effect of audience on mathematical writing. *School Science and Mathematics Journal, 109*(2), 116-127.

Seo, B-I. (2015). Mathematical writing: What it is and how do we teach it. *Journal of Humanistic Mathematics, 5*(2), 133-145. doi: 10.5642/jhummath.201502.12

Sfard, A. (2000). Symbolizing mathematical reality into being--Or how mathematical discourse and mathematical objects create each other. In P. Cobb, E. Yackel, & K. McClain (Eds.) *Symbolizing and Communication in Mathematics Classrooms* (p. 37-98). Mahwah, NJ, U.S.A.: Lawrence Erlbaum Publishers.

South Africa has one of the world's worst education systems. (7 January 2017). *The Economist.* Retrieved from https://www.economist.com/middle-east-and-africa/2017/01/07/south-africa-has-one-of-the-worlds-worst-education-systems

Staff Writer. (2018). School pass marks in South Africa vs. the rest of the world. *BusinessTech.* Retrieved from https://businesstech.co.za/news/lifestyle/231111/school-pass-marks-in-south-africa-vs-the-rest-of-the-world/

Van Dijk, T. A. (2008). Critical discourse analysis and nominalization: Problem or pseudo-problem? *Discourse & Society, 19*(6), 821-828.

Van Dyck, M., & Heefer, A. (2014). Script and symbolic writing in mathematics and natural philosophy. *Foundations of Science, 19*(1), 1-10.

Appendix A: Interview Questions

1. What is your initial feedback to the sessions? Did you like them? Not like them? Why?

2. What is your initial feedback on the reading exercise?

3. What is your initial feedback on the writing exercise?

4. What did you learn from these sessions?

5. If given the opportunity, would you come back next year? Why/Why not?

Appendix B: Handout from the Reading Lesson

Math Vocabulary

Everyday Words	Math Equivalent
And, Also	Addition
Everyone, All	Addition
From, Between, Remaining	Subtraction
Of	Multiplication
Into, Per, For	Division
At least	Greater than or equal to
No more than	Less than or equal to
What, How much	Variable
Is, Has, Have	Equal to

"Grammar/Mechanics" to Keep in Mind

• Sentences = Equations

• Include units within the equation from the text.

• Addition/Multiplication: Forward construction

• Subtraction/Division: Reverse construction

• Names = Variables

Math Instruction to Keep In Mind

- Identify the variables.

- Diagrams help organize the information.

- Percentages need to be changed to fraction or decimal form.

- Units matter.

- Not all of the information in the word problem is relevant.

- When reading word problems during lecture, use English/home-language/English structure.

- Everything you teach needs to have the 4-R's: Real, Relevant, Reflective, Responsive

Appendix C: Equations in the Writing Lesson

Equation 1: $x + y = 15$

Equation 2: $(2 \div 5d) = (7 \div 4d)$

Equation 3: $(a^2 - b^2)$

Equation 4: $6a^2 + 18a + 12$

Equation 5: $3c^2 - 6c - 9$

SEAMLESS INTERACTION OF SCHOOLS, COMMUNITIES, AND PARENTS THROUGH IMFUNDO-SA SYSTEM

Reuben Dlamini

University of the Witwatersrand, South Africa

Reuben.Dlamini@wits.ac.za

Abstract

South African schools continue to experience challenges at multiple levels. There is a need for innovative strategies to unlock the communication between parents, teachers, and learners in order to engage in the educational development of the learner. The purpose of this study was to examine and describe the Imfundo-SA education solution that is based on the ecological theory. It supports meaningful interactions between communities (parents) and the schools to continuously profile learners' performance and achievement. In addition, this article presents the profile of Imfundo-SA and a conceptual analysis of Imfundo-SA education solution's potential to enrich the relationship between schools and parents. During the analysis it became clear that the schooling environment is consonant with complexity theory, and having Imfundo-SA education solution implemented in schools will enable three key aspects of an interactive education environment: e-communication between parents and teachers, built-in threaded discussions, and managing content and school resources.

Keywords: Computing-Centric Interaction; Technology in Schools; ICT in Education

Introduction

Prior to 1994, many black South Africans did not receive adequate education due to the apartheid education system (Skosana & Monyai, 2013). It was the new constitution of 1996 that "ushered new perspectives and paradigms in both the political arena and in the education circles in South Africa" (Skosana & Monyai, 2013, p. 51). However, this does not mean that post 1994 translated into equal education and reform being achieved. The unfortunate reality is that schools continued to experience both cognitive and not cognitive problems among learners. Non-cognitive factors are crucial to learners' performance, and the focus here will be on the non-cognitive factors because learners must develop certain "sets of behaviours, skills, attitudes, and strategies" beyond content knowledge (Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson, & Beechum, 2012, p. 2). This work does not

overplay the dichotomy between cognitive and non-cognitive factors because "few aspects of human behaviour are devoid of cognition" (Borghans, Duckworth, Heckman, & Weel, 2008, p. 974). The goal of the study is to look at how Imfundo-SA created a holistic solution through a multidimensional approach to alleviate the challenges in South African schools. Chapter 9 of the National Development Plan (NDP) states: The priorities in basic education are human capacity, school management, district support, infrastructure and results-oriented mutual accountability between schools and communities (National Planning Commission, 2013).

The idea of schools operating in isolation within communities and sociocultural systems is a concern. Adelman and Taylor (2007) remarked, "schools are located in communities, but are often "islands" with no bridges to the "mainland" (p.7). However, continuous interaction between schools and communities is essential to create functional schools. Hence, there is a great need to link communities and schools to enhance learners' educational attainment and improve the use of resources. According to Jehl (2007), by "strengthening community organizations and connecting them to schools all young people in tough neighbourhoods will achieve the aspiration that their families have for them: To graduate from school prepared for adult success and well-being in the worlds of work, family, and citizenship" (p. 3). Jehl (2007) went on to affirm that partnerships between schools, families, and community organizations can improve results, strengthen schools' relationships with communities, and improve transitioning for young people across levels of development.

Clearly, schools cannot exist as islands and a productive dialogue or interaction between schools and parents is vital. However, time and distance prevent continuous interaction between schools and parents. Imfundo-SA saw that mobile technologies (cell phones and smart phones) can be the bridge to connect schools and parents and to enable parents, all of who are constantly balancing responsibilities and multitasking, to support their children's education and cognitive development process concurrently. Lewin & Luckin (2010) saw technology as the means to overcome common barriers to parental involvement. The potential for technology to effectively improve communication between the home and school cannot be underestimated. Mobile technologies can be used to continuously inform parents about learners' academic performance and attendance to classes.

The Creation of the Imfundo-SA Education System

Meaningful interaction between parents and schools appears to be missing in the educational experience of every child. Most interactions happen when parents are obliged to attend parent meetings. The 'kernel of the problem' lies in the broken relationship between parents and the schools their children are attending and there is a "link between parents' involvement activities and students' proximal achievement outcomes" (Ice & Hoover-Dempsey, 2011, p. 343). In an effort to bring parents closer to their children, Imfundo-SA was developed to enable continuous interaction between parents and the schools. The Imfundo-SA system provides a better means to achieve the fundamental aim of education and to enable parents to participate in the educational development process of their child. Through their mobile devices parents know when their children arrive at school, have access to their continuous assessment profile, and know when their children leave school and other educational activities.

The importance of parents' involvement in the educational development of learners cannot be underestimated. It is significant that meaningful parental involvement in the cognitive development of learners could translate to contextual motivation while learners are at home and school. This notion is confirmed by Hohlfeld, Ritzhaupt and Barron (2010) who assert that "parental involvement in schools positively impacts student achievement, reduces student absenteeism…" (p. 391). The participation of parents in schools has the potential to enhanced academic performance and improved use of resources in schools. In the quest to address schools' problems, analytics are used more like a flashlight, as strategic questions are being asked. The productive relationship of analytics and technology could enable teachers to better engage parents in school activities and connect parents to interfaces that provide a comprehensive view of each learner's profile. This productive relationship unlocks an educational space for schools and parents to deliver timely resources to learners struggling academically.

Struggling academically can be a source of discouragement and result in learners dropping out of school. According to Rusznyak (2014), "data from the census estimates that only 48% of students who begin Grade 1 actually complete Grade 12." That means that about 52% of learners drop out of the school system. Such an alarming dropout rate constrains the country in its efforts to realise real economic growth and an acceptable quality of life for all South

Africans. Wilkinson (2014) said when the "2013 matric class started grade one in 2002, there were 1,261,827 pupils. But by the time they came to sit for their final exams, their numbers had decreased to 562,112." The consistent upward trend in the matric results cannot be used as the only indicator of a working school system when approximately 52% of pupils do not sit for their matric exams.

It is obvious that the Imfundo-SA educational solution team was not moved by the hype associated with the pass rate when they began to study under-performing schools to probe the 'kernel of the problem'. The poor retention rate of learners makes it clear that the matric exam is designed to compare only the performance of learners who sit for the exam yearly. This supports the limited conception of the matric results. In addition, correlating the pass rate to functioning schools in isolation is inadequate. Maybe considering TIMSS (Trends in Mathematical and Science Studies) and SACMEQ (Southern and Eastern Africa Consortium for Monitoring Education Quality) programmes would add value to evaluations on how well the South African education system is doing (Wilkinson, 2014). In the midst of all these debates, Imfundo-SA began to contemplate innovative ways to track learners' performance in the classroom and simultaneously provide a platform to create a productive relationship between schools and parents.

Imfundo-SA team realized that education was a societal issue with multiple stakeholders playing different roles. For example, managing classrooms involves a lot of paperwork, and it can be difficult to timeously submit the learners' attendance and performance records. The Imfundo-SA solution transformed the challenging exercise of manual documentation of learners' performance and physical capturing of attendance. Attendance is a big concern because of the safety concerns to those involved in the educational process. The Imfundo-SA system, through its intelligent user interface, facilitates functions such as automatic and seamless enrolment of learners for educational and administrative purposes. The intelligent user interface allows parents to access their children's profiles without having to spend time travelling to schools to meet with teachers or to depend on the learners for school related information and announcements. Moreover, this system provides a better way to organise learners' classroom performance and collect information to uncover learners challenges much earlier so that creative and well-informed interventions are developed and rolled out. Consequently, this in turn translates to improved retention rates in the education system.

The Link between Parents and the School

The connection between parents and the school improves parents' participation in the education process of their children. The current system of computing administrative records is static, full of deficiencies, and impedes continuous parent participation in the education system. Granted, meetings are called periodically, but the Imfundo-SA system enables parents to track their children in the education system in real time. The provisioning of the Imfundo-SA system has positively changed the alienation of parents from the schooling system, thereby restoring parental participation in the school life. In the process, an interactive schooling system is developed. The link between parents and the schools could be used to dismantle some of the social and behavioural issues experienced by educators in the classroom. Community (parental) involvement is key to overcome the social forces that in turn influence patterns of social behaviour. The problem of absenteeism by learners and teachers is a product of social behaviour and of individuals who are unaccountable to the communities schools operates in.

The social behaviour is a result of many factors and of inherited patterns of poverty, racism, sexism, and negative attitudes towards school in South Africa (Presidency, S. A., & UNICEF. 2009; Department of Education, 2006). However, continuing to place blame on various 'isms' is not an option. The time to kick off innovative measures to curb such ills and to inspire change in the communities is long overdue. The Imfundo-SA team studied the 'Three-Component Framework for School Improvement' to support the 'no child left behind' phenomenon, regardless of their socio-economic background (Adelman & Taylor, 2007). The integrated Imfundo-SA education solution design became a reality in order to support government efforts to have functioning schools across the country. The government of South Africa wanted to achieve a universal primary education by 2015 and needed an integrated solution to prevent the leaks in the education system. Given the complexity of the South African schooling sector, Imfundo-SA, through the vision of its founder, decided to develop inclusive centres of excellence where parents can be actively engaged in the school and the educational development of their children.

Schools in South Africa operate within a highly unequal society and it is important that government officials, school governors, school principals, school teachers, learners, and the community (parents) are all committed to the Code of Quality Education enshrined in the

Kliptown Pledges. In addition to the Code of Quality Education, the three-component framework for school improvement can be adopted (Adelman and Taylor, 2007). The framework is designed to clarify how schools and communities can work together "to develop a comprehensive, multifaceted, and cohesive approach for strengthening youngsters, families, schools, and neighbourhoods" (p. 71). Figure 1 illustrates "an enabling component that compliments efforts" to address barriers "to learning, development, and teaching" as well as interfering factors to the schooling system (Adelman and Taylor, 2007, p. 72).
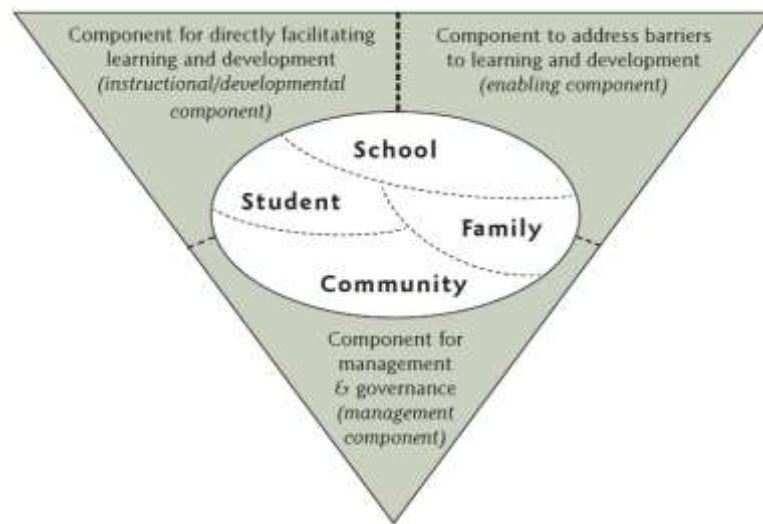
Figure 3 The Three-Component Framework for School Improvement (Adelman & Taylor, 2007, p. 71)

The next section examines various studies on how technology tools have been used in schools and institutions of higher learning to connect parents, learners, schools, and community. Technology, especially mobile technology, seems to have the same vitality regardless of where it is being used—schools, home, and communities. Technology "seems to have few limitations and almost magical strength" (Blanchard, 1998, p. 253). In this case, the partnership between schools and parents is facilitated with mobile technologies to address problems related to attendance, retention, progression, and literacy determined achievement.

Technology as a Bridge

Contemporary technologies are overcoming the shortcomings of traditional channels of communications (Longfellow, 2004, p. 37). Mobile technologies dominate South African life and have become an integral part of our families. People who work and reside in urban areas or big cities like Johannesburg but still have their immediate families located in rural areas

rely on technology to keep in touch and get updates on various community activities. Blanchard (1998) opined that,

> *Modern technology is seen by many as a new Prometheus: The creator of a modernistic order. But this inclination to ascribe mythical powers to technology presents technology with monumental tasks that it is expected to accomplish under a variety of dazzlingly difficult and almost impossible conditions (p. 235).*

Technology has the crucial role of keeping the "two major institutions of learning for children: Families and schools" (Blanchard, 1998, p. 235) connected. Evidence of this is revealed through studies that have shown that the relationship between the two major institutions of learning is important in the educational development of children (Booth & Dunn, 1996; Blanchard, 1998; Scott-Jones, 1995; U.S. Department of Education, 1994). Mobile technology is ubiquitous, and Imfundo-SA demonstrates tangible possibilities for increasing and enhancing communication between parents and schools. According to Blanchard (1987), there are "at least four ways that technology can serve the family-school connection: Communication and information; learning and instruction; interest and motivation; and resources and costs." Mobile technology ensures that two-way communication between the school and parents exists instead of the latter being only visitors in schools. Essentially, technology can open incredible new avenues to enhance and extend learning in a networked society and further increase collaboration. Blanchard (1998) states, "the family-school connection and technology is about using technology as a tool to develop and enhance the reciprocal influence of schools and homes on student outcomes". With Imfundo-SA, it is evident that technology is certainly a core element of the 21st century education.

The Imfundo-SA Education Solution

The goal is to provide a technology-supported home-school interaction to increase parents' involvement in the children's learning processes, enhance parents-school communication, and increase student engagement in their learning process. The method employed by Imfundo-SA is to bring private sector best practices into the public education environment to effect real improvement. The Imfundo-SA system mine e-learning data and compute it using statistical techniques, visualization, classification, clustering, and association rule to present

meaningful information on each learner. Analytics in education is the greatest asset in the process of learners' development, in resources allocation and in the value it adds to the learners learning experience. The Imfundo-SA system was developed using the five priority goals and goal 22 of the 'Action Plan To 2014—Towards the Realisation of Schooling 2025' (Department of Basic Education, 2011). The five priority goals and goal 22 are:

Goal 11: Improve the access of children to quality Early Childhood Development (ECD) below Grade 1.

Goal 16: Improve the professionalism, teaching skills, subject knowledge, and computer literacy of teachers throughout their entire careers.

Goal 19: Ensure that every learner has access to the minimum set of textbooks and workbooks required according to national policy.

Goal 21: Ensure that the basic annual management processes take place across all schools in the country in a way that contributes towards a functional school environment.

Goal 27: Improve the frequency and quality of the monitoring and support services provided to schools by district offices, partly through better use of e-Education.

Goal 22: Improve parent and community participation in the governance of schools, partly by improving access to important information via the e-Education strategy.

Following the adoption and understanding of these goals, the following questions were asked during the development of the Imfundo-SA education solution:

- Given the contemporary education context, how can teachers effectively track the progress of their many students?

- How can schools guarantee quality and meaningful parent participation in the life of their learners?

- Given the contemporary education context, how can parents continuously track the progress of their children?

- What are the exemplary interactive activities that can help establish meaningful parents-school engagements?

While it is not the intention of the article to compare the Imfundo-SA system with Learning Management Systems (LMS), it is noteworthy that it can be used as a learning platform, content manager, sharing platform, and administrative platform. Similarly, Imfundo-SA education system supports both administrative and pedagogical functions:

- Class management (attendance, registration, manage learners' activities, enrol/unroll learners)

- Content management (upload learning materials, digital resources, repository)

- Communication (announcements, learners' activities, update on learners' performance)

Though the Imfundo-SA education solution is at its initial phase, the possibilities of the intertwined educational and administrative functionalities provide a paradigm shift from an LMS system. The Imfundo-SA system facilitates flexible schooling environment management, continuous interaction between the school and parents, communication, as well as learner support. This IT solution provides real-time visibility on the learners' and school's profile. The Imfundo-SA system framework is complemented by the ecological theory that is based on the "interdependence and relationships between different organisms and their physical environment" (Holley, 2009, p. 18). According to Imfundo-SA, the schools cannot exist in isolation because parental participation is important for a functioning school. There is a symbiotic relationship between a functioning school and parental or community engagement in the school and the eventual cognitive development of the learner. Figure 2 demonstrates the integrated approach of the functional areas of the solution.
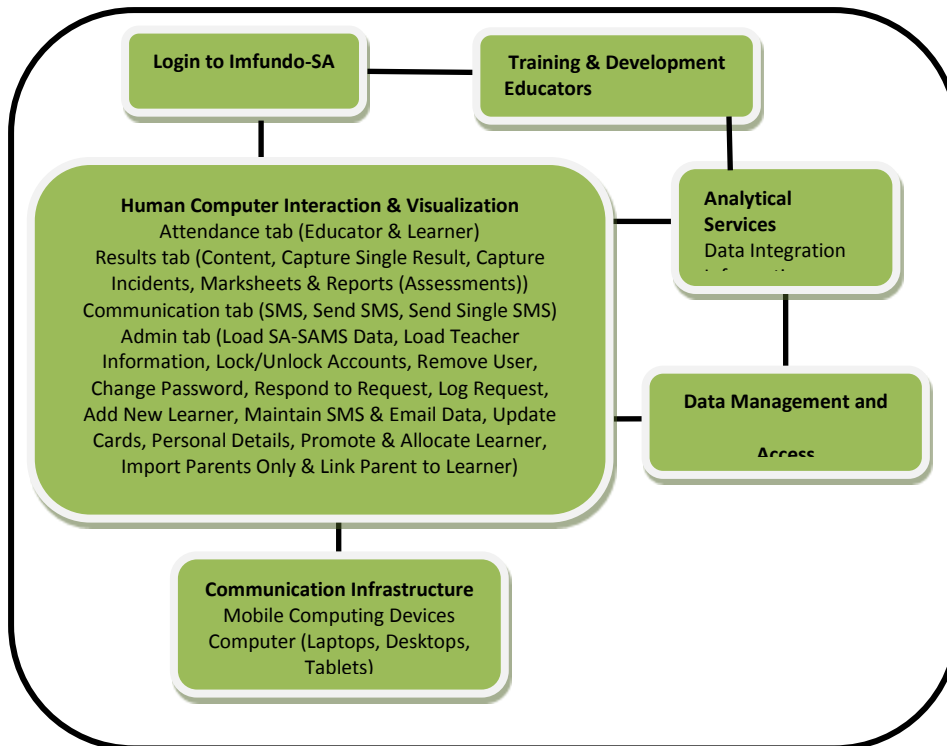
Figure 4 Imfundo-SA Education Workflow Interface

With the pressures on the South African school systems well-documented, Imfundo-SA solution is a new response to the pressing national needs to deliver functioning schools. The provisioning of this system aligns itself with Kirkup and Kirkwood (2005) and with Wagner (2001) who argues that it is the "contextualised teaching and learning needs that ought to drive the ICT intervention, rather than the technology itself" (Jaffer, Nga'ambi & Czerniewicz, 2007, p. 131). Thus, the underlying argument of this paper is the re-conceptualization of school technology. Table 1 provides the key features of the solution and functions:

Table 1 Imfundo-SA Education Solution

Feature	Function
Imfundo-SA Online System	The platform provides a one stop portal to information about learners' performance and class activities such as assignments, tests, attendance, etc. In addition, announcements can be made and reports can be printed, depending on users' privileges.
Face/Biostation (Mobile Units)	Face recognition system for attendance and to provide feedback to parents or guardians that learners attended classes at school.

Learner Student Cards	Swipe cards for attendance and provide feedback to parents or guardians that learners did arrive at school.
Training of Educators: ICT Integration	Development of teachers' ICT know-how and how to pedagogically integrate ICT tools in the classroom.
Productivity SA Training	Professional development of management (principals, deputy principals, and heads of divisions or departments)
Educator Teacher Development	Developing teachers' ICT pedagogical integration in teaching learning.
2-way SMS communication between schools, district, and parents	Using mobile technology to enable continuous interaction within communities.

For a school to function at optimal level, resources need to be mapped and analysed to expand opportunities for learners' and the school's development. Organizing the school environment is fundamental to appropriate decision making and to functioning schools. The need for quality data cannot be underestimated as it promotes appropriate accountability, sound planning, and implementation. The Imfundo-SA education solution links schools and communities so that they can collectively achieve a shared vision of success. Imfundo-SA is a well-conceived information infrastructure designed to create interaction between parents and schools based on the principles of parent and community involvement, collaborative governance, and continuous two-way communication between family and the school.

The Imfundo-SA System Framework

The Imfundo-SA system adopted Java-based Service-Oriented Architecture (SOA) design facilitated by Web services technologies. SOA provides an evolutionary approach to building distributed applications and is not a technology but a set of architectural principles independent of any software or platform and follows an incremental approach. A Web service is a software system designed to support interoperable machine-to-machine interaction over a network (W3C, 2004). By implementing SOA with Web services this education solution achieved a platform-neutral approach and better interoperability. The system can track and retrieve learners' information in real-time. Government officials can easily generate reports with credible information to provide insights on learners and the functioning of the school. The system collects data in real-time, integrates it for learners' critical performance factors,

and then enables proactive management of learners and optimization of educational resources to realize value. Figure 3 provides the anatomy of Web services whereby policies are integrated in the Imfundo-SA system solution.
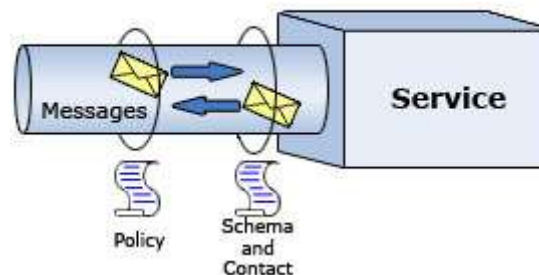
Figure 5 Anatomy of a Web Service

The visualization of the learners' performance profile affords teachers and parents with early opportunities for providing additional learning assistance and intervention. The capacity to establish early indicators of 'at-risk' learners provides timely opportunities for teachers and parents to add resources to facilitate progression towards optimal patterns of learning behaviour. The intelligent Imfundo-SA web system links data and complements the current manual processes being used in schools to enhance decision making, teaching, and learning. Because the system is not platform specific, it already aligns itself with cloud computing, which will be the prevalent computing platform of the future.

With schools under intense pressure to retain learners and to make sure they are successful in the pursuit of the education, there is a great need to have a meaningful, accessible and timely management of information. For a long time, the business sector has used business intelligence for a competitive advantage while schools still lag behind. Goldstein (2005) describes academic analytics as "the intersection of technology, information, management culture, and the application of information to manage the academic enterprise" (p. 2). The Imfundo-SA team looked at the following three dimensions as they began to conceptualize the education solution: Accessing of timely information, ability to make information widely accessible, and the use of technology to support functional areas in schools. Thus, a well-designed information management system had to be developed to support learning both in and out of the classroom, enhance teachers working life, and interact meaningfully with

external structures. The Imfundo-SA system provides a platform for computerized and appropriately networked information management system to ensure data integrity.

Discussion and Conclusion

This paper presented the architecture of a platform with the potential to bridge the link between parents, schools, and learners. The platform models and uses real-time time information to profile learners and help parents understand the performance of their children throughout their school years. The Imfundo education solution enables families to really work together with the schools and this sets the stage for learners to take their education seriously. According to research conducted by the Southwest Educational Development Laboratory, linking schools with communities enable learners to attend classes regularly and, in the process, increases completion rates and the learners' socio-economic levels show gains across a variety of indicators (Darling-Hammond & Richardson, 2009; Epstein & Salinas, 2004). The Imfundo-SA education solution addresses a number of challenges in the current schooling reality that constantly challenges education and learners' cognitive and non-cognitive development. The meaningful interaction between parents and schools requires a concerted effort to enhance learners' performance, increase the retention rate, increase attendance, and improve the use of resources.

It is evident that technology builds bridges from schools to communities and vice versa, which helps parents and schools to collaborate to achieve the shared goal of improving learner performances. Furthermore, technology offers an excellent way for interactive information sharing and the delivery of services over the Internet. Universal computing devices such as mobile phones play a critical role in building bridges that connect communities with schools. The service-oriented computing adopted by Imfundo-SA adds to the fundamental transformation of education to modernize it and increase quality, equity and personalization. With social progress and technological advancement, ICT tools have enabled changes in the way we live and interact: "Supporting different senses, supporting collaboration, supporting differentiation and diversity, and empowering learners" (Ala-Mutka, Punie, and Redecker, 2008).

For schools to be relevant in a knowledge society, innovative initiatives should be adopted to complement expectations and increase functionality of schools. From a didactic point of view, the adoption of Imfundo-SA education solution has great potential to automate school

processes or move schools to a process-oriented approach. Therefore, it enables schools and communities to continuously interact beyond cognitive factors as they pursue a shared agenda and achieve a collective vision. The continuous interaction between schools and communities represents a promising intervention to address the challenges and barriers to learning and to concurrently strengthen relationships between families and schools. The symbiotic relationship between education and information technology (IT) has enabled Imfundo-SA to implement smarter learning environments that facilitate early detection of, and response to, educational events surrounding learners at schools. Vital parameters of the schooling environment are continuously monitored, making information available to government officials, school governors, school principals, school teachers, parents, and learners, when needed. The Imfundo-SA educational solution views learners' performance and success as part of a complex educational system of interdependent interactions and co-operations and by bringing parents to the solution add an interactional recursive engagement between the internal (school) and external (community) environment.

References

Adelman, H. S., & Taylor, L. (2007). Systemic change for school improvement. *Journal of Educational and Psychological Consultation*, *17*(1), 55–77.

Ala-Mutka, K., Punie, Y., & Redecker, C. (2008). Digital competence for lifelong learning. *Institute for Prospective Technological Studies (IPTS), European Commission, Joint Research Centre. Technical Note: JRC*, *48708*, 271–282.

Blanchard, J. (1998). The family-school connection and technology. Proceedings of *The Families, Technology, and Education Conference*, October 30–November 1, 1997, Washington DC.

Booth, A., & Dunn, J. (Eds.). (1996). *Family-school links: How do they affect educational outcomes*. Mahwah, NJ: Lawrence Erlbaum.

Borghans, L., Duckworth, A. L., Heckman, J. J., & ter Weel, B. (2008). The economics and psychology of personality traits. *IZA Discussion Papers*, No. 3333.

Darling-Hammond, L., & Richardson, N. (2009). Research review/teacher learning: What matters. *Educational leadership*, *66*(5), 46-53.

Department of Basic Education. (2011). *Action plan to 2014: Towards the realisation of schooling 2025*.

Department of Education. (2006). *Monitoring and evaluation report on the impact and outcomes of education system on South Africa's population: Evidence from household surveys*. Department of Education.

Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., & Beechum, N. O. (2012). *Teaching adolescents to become learners. The role of noncognitive factors in shaping school performance: A critical literature review*. Chicago: University of Chicago Consortium on Chicago School Research.

Goldstein, P. J., & Katz, R. N. (2005). *Academic analytics: The uses of management information and technology in higher education*. EDUCAUSE.

Hohlfeld, T. N., Ritzhaupt, A. D., & Barron, A. E. (2010). Connecting schools, community, and family with ICT: Four-year trends related to school level and SES of public schools in Florida. *Computers & Education*, *55*(1), 391–405.

Holley, B. (2009). *The academic challenges experienced by learners from a local informal settlement attending a public (former Model C) suburban secondary school* (Doctoral dissertation, University of Johannesburg).

Ice, C. L., & Hoover-Dempsey, K. V. (2011). Linking parental motivations for involvement and student proximal achievement outcomes in homeschooling and public schooling settings. *Education and Urban Society*, *43*(3), 339–369.

Jaffer, S., Ng'ambi, D., and Czerniewicz, L. (2007). The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2007, Vol. 3, Issue 4, pp. 131–142.

Jehl, J. (2007). Connecting Schools, Families, and Communities: Stories and Results from the Annie E. Casey Foundation's Education Investments.

Kirkup, G. & Kirkwood, A. (2005). Information and communications technologies (ICT) in higher education teaching – a tale of gradualism rather than revolution. *Learning, Media and Technology*, *30*(2), 185–199.

Lewin, C., & Luckin, R. (2010). Technology to support parental engagement in elementary education: Lessons learned from the UK. *Computers & education*, *54*(3), 749-758.

Longfellow, C. A. (2004). Enhancing school-home communication through technology in Christina School District. *Dissertation Abstracts International*, *65*(05), 1748. (UMI No. 3133814)

National Planning Commission. (2013). National development plan vision 2030.

Presidency, S. A., & UNICEF. (2009). Situational Analysis of Children in South Africa.

Rusznyak, L. (May 7, 2014). South African education still fails many 20 years after Apartheid. *The Conversation*. https://theconversation.com/south-african-Education-still-fails-many-20-years-after-apartheid-22069

Scott-Jones, D. (1995). Parent–child interactions and school achievement. In B. Ryan, G. Adams, T. Gullotta, R. South Africa.

Skosana, P. S., & Monyai, R. B. (2013). Learner-Centred policies with reference to constructivism in the implementation of the curriculum. *International Journal of Humanities and Social Science Invention*, *2*(9), 51–58.

U.S. Department of Education. (1994). *Strong families, strong schools*. Washington, DC: Author. (ERIC Document Reproduction Service No. ED 371909)

W3C (2004). *W3C: Data Access Working Group Website*. http://www.w3.org/2001/sw/DataAccess/

Wagner, A. D. (2001). IT and education for the poorest of the poor: constraints, possibilities, and principles. *TechKnowLogia*, July/August, 48–50.

Wilkinson, K. (January 7, 2014). Why the matric pass rate is not a reliable benchmark of education quality. *Africa Check*. http://africacheck.org/reports/why-the-matric-pass-rate-is-not-a-reliable- benchmark-of-quality-education/#comments

IMPACT OF TEACHERS' PROFESSIONAL DEVELOPMENT ON EFFECTIVE TEACHING OF BUSINESS STUDIES AT JUNIOR SECONDARY SCHOOL IN ADO LOCAL GOVERNMENT AREA OF EKITI STATE

Falade, Christianah Adekunbi
Ekiti State University Ado. Ekiti State, Nigeria

falade.christy76@gmail.com

Abstract

The study investigated teachers' perception on the impact of professional development programmes on effective teaching of business studies in junior secondary schools in Ado Ekiti. The study adopted descriptive research of survey design, with population of all 89 business studies teacher in Junior Secondary School in Ado Ekiti. 41 business studies teacher were selected using purposive sampling technique. A self-structured questionnaire tagged Teachers' Perception on the Impact of Professional Development Programme Questionnaire (TPIPDPQ) was used to collect relevant data for the study. The data collected were analyzed using descriptive and inferential statistics. All hypotheses were tested at 0.05 level of significant. The findings revealed the differences among teachers participation in Seminar, conference and workshop. Also, the study specifically shows that the mean scores of teachers in seminar is apparently higher than the mean score of teachers in workshop and conference. The study concluded that for effective teaching of business studies, teachers must participate in professional development such as; seminar, conference and workshop. Based on the findings of this study, it was recommended among others that the educational authorities should create awareness for teachers as to the need for regular participation in professional development programmes.

Keywords: Conference, Effective teaching, Professional Development Programme, Seminar, Workshop.

Introduction

Teaching is the arrangement of situations which will lead to desirable and satisfying ends. Ifeagwu (2000) defined teaching as a two-way traffic system involving exchange of ideas between the teacher and the students .Also, teaching according to Adeola (2011) is the process of imparting in the students, knowledge, skills and attitude in order to bring about a

desirable change in learners. To be effective in teaching, professional development must provide teachers a way to directly apply what they learn to their teaching. Greenleaf and Katz (2004) opined that professional development leads to better instruction and improved student learning when it connects to the curriculum materials used by teachers, the academic standards that guide their work, and the assessment and accountability measures that evaluate their success.

In education, the term "professional development" may be used to mean wide variety of specialized training, formal education, or advanced professional learning intended to help administrators, teachers, and other educators to improve their professional knowledge, competence, skill, and effectiveness. Professional development programmes are imperative for teachers in Nigeria secondary schools because it is an effective medium through which teachers can achieve their desired growth and self-actualization. Alabi (2000) posited that for an employee to continue to be relevant within an organization like secondary school, there is need for in-service training which would inculcate in the employee, the knowledge, skills, and the confidence in originating new ideas as to how best to carry out the tasks imbedded in the job (Ibrahim, 2014). Teacher has to pursue professional development in order to meet the changing needs of learning in the modern world. They have to do this by assessing and re-examining their teaching beliefs and practices. They also need to take the responsibility for their professional development in their teaching. Teacher professional development is an essential factor for teachers to function successfully.

Teacher professional development has been defined in a number of ways, providing different emphasis on a range of issues inherent to its complex nature. So teacher professional development can be defined as deepening teachers understanding about the teaching learning process and the students they teach and must begin with pre-service education and continue throughout a teacher's career (Guskey, 2002). Teacher professional development is an ongoing and continuous process throughout a teacher's career. Teachers are essential personnel in teaching profession. Teaching profession is a lifelong developmental process that involves the continual deepening of knowledge and skills.

Asomi (2013) sees effective teacher as one who helps in development of basic skills, understanding level, appropriate study habits, good work culture, favourable attitudes, value

orientation and judgement as well as adequate personal. The effectiveness in teaching business studies is seen when teachers play their role in inculcating the right attitudes into their students to enable them to enter a business career or having entered upon such a career to render more efficient serve therein and to advance their present levels of employment to higher level.

As professional development is important for any career, it is equally important for all teachers including business studies teachers. The contents in Business Studies syllabus is such that it incorporates the acquisition of both academic and practical skills that may help the students to fit into post-school working environments. This is why business studies is classified as a practical subject. Business studies teachers' effectiveness could be measured on the ability of the teacher to utilize appropriate techniques to impart in the students' knowledge, skills and competencies capable of bringing desired positive learning outcome.

Business studies is a subject that is taught at junior secondary school with aim of developing students in business management and entrepreneurial knowledge and skills that will enable them to make use of their immediate resources in starting small businesses and/or income generating projects and activities. This subject will further encourage students to be enterprising, innovative, creative and use ethical business practices. Student will learn to become responsible producers and wise consumers in their own communities whether formal or informal. Business Studies is a practical oriented subject in which students will be provided opportunities to apply entrepreneurial skills in practical projects and activities (Federal Republic of Nigeria, 2004).

Thus, in the process of professional development teaching materials, techniques and methods are constantly being updated and changed (Yoon, Duncan, Lee, Scarloss & Shapley, 2007). This implies that teachers' education alone will not be enough to serve them throughout their career. Teacher professional development means life-long learning and growing as an educator because teachers' work is never complete. Fullan (1991) defines professional development as the sum total of formal and informal learning experiences throughout one's career from pre-service teacher education to retirement. Hessel (1999) also defined professional development as the process of improving staff skills and competencies needed to produce outstanding educational results for students. (Okoli 2010) posited that professional

development is key to meeting today's educational demands because professional development is an important part of the general education which emphasizes on skills and competency acquisition. Teachers always have something new to learn, something else to share with others or another strategy or resource to create. Teachers have to be given the time to learn frequently and in a supportive manner. This provides them with regular improvement and will be useful for them and their learners (Kane & Stainger, 2012). According to Ibrahim (2014) an inspiring and informed teacher is the most important school-related factor that influences students' academic achievements. So it is critical to pay close attention to teachers training and developing as well as giving support to both new and experienced teacher.

It appears that the knowledge of the subject matter of some teachers are outdated because of not participating in any developmental programme over the years. It is impossible for any individual to learn a job or enter a profession and remain in it for long with his skills basically unchanged. The same is true for a school, a complex and dynamic organization must adapt to changing societal demands and instruction methodology. Thus, no matter how excellent the pre-service preparation and how well qualified school personnel are at the time of employment, efforts should be made to develop them personally and professionally on a regular and continuous basis. Porter, Garet, Desimone & Birman, 2003) posited that the immediate aim of teachers development programme is to improve the performance of those with teaching and management responsibilities by improving their knowledge, skills and competence, while the ultimate aim is the effective teaching of the subject matter. Professional developments programmes are basically any educational programme designed to provide in service training that is designed for people who are mentally matured, gainfully employed and are socially responsible. Thus, professional development programmes such as conferences, seminars, workshops, sandwich programmes, public lectures, in service training, collaborative development, mentoring, school based lecture and computer literacy programmes are great means of integrating literates with the current global and economic requirements within the education sector, making teachers effective, efficient and relevant in their field of study.

According to Alabi (2000) there are three types of such development programmes in Nigerian education system. These include seminar, conference and workshop. These programmes aim

at correcting deficiencies of staffs at the time of appointment. Programmes which enable teaching staff to face challenges arising from innovations in the school curriculum, programmes which enable non-professional to professionalize and programmes that enable acquisition of higher qualifications.

Considering the importance of professional development programmes and its practical implications on teachers' effective teaching in schools, this study's intent to investigate specifically some selected development programmes such as seminar, conferences, workshop, and their relationship with teachers' effective performance in teaching business studies. According to Porter, Garet, Desimone and Birman (2003), a seminar is an extended discussion led by an expert on an educational topic that usually takes place over two or three days. Participants typically read research or literature in preparation, and each day's session involves teaching such as reading discussions, presentations and group activities. While seminars are perceived to help teachers make professional connections, renew teacher's enthusiasm for a topic and gain advanced knowledge in their respective field, it can as well be a great way to immerse teachers in a particular subject for a few days.

However, the researcher observed that seminars are rarely organized for secondary school teachers in Ekiti State to update their knowledge. This appears to have caused lack of innovation in teaching and learning process thereby leading to ineffective performance of some teachers. Observation also reveals that teachers are not embracing time to time innovation in their teaching. As a result of not exposing teachers to various seminars, most of the teachers are not aware of new ideas that can help them improve their teaching in the classroom. Also, the researcher observed that the issue of not making seminar an important professional development programme is not only peculiar to government only as some teachers are involved; a situation where a teacher is lazy to attend seminars. The researcher even observed that when seminars are occasionally organized, most of the teachers are only after the stipend that will be given to them. So most teachers will go to the venue to write their names and later disappear from the venue. The perpetration of these activities seems to hinder organizing of seminars for teachers. Hence, effective teaching of business studies may be negatively affected.

Workshops on the other hand are usually brief and intensive educational programmes for a relatively small group of people that focuses especially on techniques and skills in a particular field. Broadwell (2006) stresses that the focus of workshop is to bring about curriculum change, innovation in teaching methodologies and provision of quality professional growth and development. Mostly the activities and programmes focus on developing and manifesting quality performance by the use of modern visual aids, increasing skills or knowledge in respect of teaching subject. Workshop training programme creates an avenue for individuals to work as team in solving problems, which are of common concern to all staff as well as contributing to the development of the educational objectives of the school system.

Vescio, Ross and Adams (2008) established that there is a high correlation between what teachers know and what they teach. Thus, the ability to teach effectively depends on the teacher's knowledge of the subject matter. Teachers are handicapped if they are unfamiliar with the body of knowledge taught and teachers characteristics is subject specific. Tate (2009) opined a teacher that has not participated in workshop to update his/her practical knowledge and pedagogical skill may find it difficult to effectively deliver instructions and teach very well in the class. If a teacher's pedagogical knowledge is not updated via practical sessions like workshop, nothing may be achieved during the teaching learning process. The resultant effect of this may be poor teachers' performance and consequently poor academic performance of the students. Observations further shows that most teachers in secondary schools are yet to attend any workshop on teaching skills or their area of specializations. This implies that most of the teachers are yet to update their practical knowledge since they have graduated from school. All these appear to have reduced the ability of some teachers to teach effectively.

Conference is another professional programme, it is a formal meeting of people with shared interest, typically one that takes over several days; it is synonymous to academic symposium involving a meeting of researchers on joint interest, presenting mediums of academic exchanges through scientific journals publications or presentations.

Abarikannda (2002) noted that the purpose of conference is based specially to upgrade and updating the potentiality and competency of teacher to be more supportive, participative and

achievement-oriented. In directed other words, it is goal-directed activity focusing on changing individuals' values, orientation and attitude towards learning environment. Likewise, observation shows that most teachers do not participate in conference throughout their years of service. This appears to have negatively affect the competency of teachers which seems to contribute to ineffective teaching of business studies.

Conference training appears to enhance performance as it provides access to professional growth. This helps to reduce some deficiencies in skills and methodologies in teaching. It seems that opportunities are created for teachers to persistently rise in their various transmissions of knowledge there will be innovative change in curriculum, high degree of participation in decision-making as well as standard teaching.

Despite the amount of literature on professional development, most studies on professional development have not examined its impact on effective teaching on Business Studies in Ado Local Government. Therefore, it is imperative to address this research gap, this has motivated this study to examine the impact of teachers' professional development in teaching business studies in junior secondary school at Ado local government area of Ekiti State.

Statement of Problem

The significance of Business Studies as a school subject in our junior secondary schools cannot be overemphasized. There are emphases which are widely spread among stakeholders that business studies teacher is witnessing set back in effective teaching of business studies. Various reasons have been adduced to this argument. There are some suggestions that the setback experienced by business studies is as a result of the teachers non regular participation in professional development programmes. No one is absolutely certain whether the attitude of business studies teacher towards professional development has impact on effective teaching of business studies at junior secondary school in Ekiti State or not.

Purpose of the Study

The main purpose of the study is to find out the perceptions of teachers on impact of professional development programmes on effective teaching of business studies at junior secondary school in Ado Local Government area of Ekiti State. Specifically, the study sought to:

1. Investigate the differences in the perception of teachers' participation in seminar, conference and workshop and effective teaching of business studies in Ado local government area of Ekiti State.

2. Examine whether there is any impact of teacher participation in seminar, conference and workshop on effective teaching of business studies in Ado local government area of Ekiti State.

Research Questions

The following questions were raised to guide the study:

1. Is there any difference in the perceptions of teachers' participation in seminar, conference and workshop and effective teaching of business studies in Ado local government area of Ekiti State?

2. Is there any impact of teacher participation in seminar, conference and work shop on effective teaching of business studies in Ado local government area of Ekiti State?

Research Hypotheses

The following hypotheses stated in null form were generated from the research question:

1. There is no significant difference in the perception of teachers' participation in seminar, conference and workshop and effective teaching of business studies in Ekiti State Secondary Schools.

2. There is no significant impact of teacher participation in seminar, conference and workshop on effective teaching of business studies in Ekiti State Secondary Schools.

Methodology

The following methods described the procedures used in the conduct of this study.

Research Design

This study adopted the descriptive survey research design. A survey is a process of collecting data from a specified population in order to determine the current situation of that population with respect to one or more variables (Ada, 2014). This design was appropriate for this study because the researcher collected data from secondary schools business studies teachers in Ado Ekiti local Government area in order to analyse the impact of teacher participation in seminar, conference and workshop on effective teaching of business studies.

Population of the Study

The targeted population of the study comprised all the (89) business studies teachers in the 18 junior secondary schools in Ado Local Government Area of Ekiti State, Nigeria.

Sample and Sampling Technique

A total sample of 41 business studies teachers were selected using purposive sampling technique.

Research Instrument

A self-structured questionnaire containing 20 items was designed by the researcher which was used for gathering the data needed. The questionnaire was divided into two (2) sections Section A requested for the personal information e.g sex, age, course taught, year of working experience etc. Section B consisted of the 20 items questions to elicit the responses on their perception on the impact of professional development programmes on effective teaching of business studies.

Validity of the Instrument

In order to ascertain the validity of the instrument used for study, the draft questionnaire was given to two experts in educational management from the faculty of education Ekiti State University, Ado Ekiti. They made useful suggestions that led to some corrections in the final draft of the instrument.

Reliability of the Instrument

The reliability of the instrument was established by conducting a test-retest on randomly selected teachers of 2 secondary school outside the schools that were used for the study in Ado Local Government Area. The first set of instrument was administered to the respondents and the second set of the instrument was re administered to the same set of respondent after two weeks interval within the time of administration. Pearson's Product Moment Correlation was used in establishing its reliability and a correlation coefficient of 0.72 indicates that the instrument was reliable for the study.

Methods of Data Collection

The researcher visited the selected schools to administer the questionnaire personally to the respondents and collected copies immediately from the respondents thereby ensuring 100% return rate.

Methods of Data Analysis

The data collected was analysed descriptively using mean and standard and inferential statistics. To test hypothesis one, t-test was used while ANOVA was used to test hypothesis two. Both hypotheses were tested at significance of 0.05 alpha level.

Research Question One: Is there any difference in the perception of teachers' participation in seminar, conference and workshop and effective teaching of business studies in Ekiti State Secondary Schools?

Table 1 Descriptive analysis of mean and standard deviation of perception of teachers' participation in seminar, conference and workshop.

Variables	N	Mean	S.D
Seminar	41	83.22	8.74
Conference	41	70.80	6.47
Workshop	41	75.54	11.57
Total	123	76.52	10.44

Table1showed that the mean scores of teachers on seminar, conference and workshop to be 83.22, 70.80 and 75.54 respectively and their standard deviation as 8.74, 6.47 and11.57 respectively.

Research Question Two: Is there any impact of teacher participation in seminar, conference and workshop on effective teaching of business studies in Ekiti State Secondary Schools?

Table 2: Descriptive analysis of Mean and Standard deviation showing the impact of teacher participation in Seminar, Conference and Workshop

Variables	N	Mean	S.D
Seminar	41	83.22	8.74
Conference	41	70.80	6.47
Workshop	41	75.54	11.57
Total	123	76.52	10.44

Table 2 showed that the mean scores of teachers on seminar, conference and workshop to be 83.22, 70.80 and 75.54 respectively and their standard deviation as 8.74, 6.47 and11.57 respectively.

Hypothesis 1

There is no significance difference in the perception of teachers' participation in seminar, conference and workshop and effective teaching of business studies in Ekiti State Secondary Schools

Table 3: Analysis of variance showing the perception of teachers' participation in seminar, conference and workshop and effective teaching of business studies

Perception	Sum of square	Mean of square	Df	Fcal	F table
Between	3291.041	1609.520			
Within group	10093.659	84.11 4	40	19.135	2.45
Total	13312.699				

*P>0.05

Table 3 shows that fcal (19.135) is greater than f table (2.26) at 0.05 level of significance. The null hypothesis is not accepted. It implies that there is significance difference in the perception of teacher participation in Seminar, Conference and workshop for effective teaching of business studies.

Hypothesis 2

There is no significance impact of teacher participation in seminar, conference and workshop and effective teaching of business studies in Ekiti State Secondary Schools.

Table 4: Analysis of Variance showing the impact of teacher participation in seminar, conference and workshop and effective teaching of business studies

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3219.041[a]	2	1609.520	19.135	.000
Intercept	720209.301	1	720209.301	8.562E3	.000
Group	3219.041	2	1609.520	19.135	.000
Error	10093.659	120	84.114		
Total	733522.000	123			
Corrected Total	13312.699	122			

a. R Squared = .242 (Adjusted R Squared = .229)

Table 4 showed the Fcal (19.135), R Squared (0.242) and Adjusted R Squared (0.229). The null hypothesis is not accepted, this implies that there is significant impact of teacher participation in seminar, conference and workshop on effective teaching of business studies.

Discussion

The findings of this study revealed that there is significance difference in the perception of teacher participation in Seminar, Conference and workshop for effective teaching of business studies. The mean scores of teachers on seminar is apparently higher than the mean score in workshop and conference. This finding is in contrast with the findings of Tate (2009), who opined that a teacher that has not participated in workshop to update his/her practical knowledge and pedagogical skill may find it difficult to effectively deliver instructions and teach very well in the class. However, this study is in line with the findings of Porter, A. e tal (2003),who perceived seminar as an extended discussion led by an expert on an educational topic that helps teachers to make professional connections, renew teacher's enthusiasm for a

topic and gain advanced knowledge in their respective field, it can as well be a great way to immerse teachers in a particular subject for a few days.

The study also revealed that there is significant impact of teacher participation in seminar, conference and workshop on effective teaching of business studies. This finding is in agreement with the findings of Okoli, (2010) who posited that professional development is key to meeting today's educational demands because professional development is an important part of the general education which emphasizes on skills and competency acquisition.

Conclusion

The findings of this study revealed the difference among teachers participation in Seminar, conference and workshop. The study specifically shows that the mean scores of teachers in seminar is apparently higher than the mean score of teachers in workshop and conference. The study similarly shows that there is significant impact of teacher participation in seminar, conference and workshop on effective teaching of business studies. It is hereby concluded that for effective teaching of business studies, teachers must participate in professional development such as; seminar, conference and workshop.

Recommendations

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

1. Educational authorities should create awareness for teachers as to the need for regular participation in professional development programmes
2. There should be regular participation of teachers in seminar, conference and workshop to enhance their effectiveness in teaching of business studies

References

Abarikannda, B.A. (2002) Gender Issues in Teacher Production Utilization and Turnover Pattern in Nigeria's Educational System. A Case Study of Adeyemi College of Education, Ondo. *Journal of Teacher Production Utilization and Turnover Patterns in Nigeria.* 3(1) 66-70.

Ada, J.N. (2014) Impact of principals' supervisory roles on student's academic performance in secondary schools in Kwanda Local Government Area of Benue State, Nigeria. *International Journal of Innovative Education Research,* 2(1), 45-56.

Adeola, L.K. (2011). An agreement of the teaching effectiveness of prevocational subjects in Ogun State, Nigeria. *International Journal of Vocational and technical education, 3(1), 5-8.*

Alabi, A.T. (2000) *School Personnel Management.* In D.O Durosaro,& S. Ogunsaju (Eds.). *The Craft of Educational Management,* (165-168).Ilorin: Haytee.

Asomi C. *(2013),* A Study on Teacher Effectiveness with special reference to Secondary Teachers in District of Assam *Journal Of Humanities And Social Science 15,(4) 28-31*

Broadwell, M. (2006). *Class Instruction as part of Training and Development. Handbooks: A Guide to human Resourse Development.* Lagos. Stanley Prints.

Diamond, D. (2008). Teacher learning: the key to education reform. *Journal of Teacher Education,* 59(3), 226-234.

Federal Republic of Nigerian (FRN, 2004). *National policy on education. Lagos*: NERDC Press.

Fullan, M.G. (1995). *The limits and the potential of professional development.* In T. Guskey and M. Huberman (Eds.), Professional Development in Education: New Paradigms and Practices, pp 253-267. New York: Teachers College Press.

Greenleaf F. (2004). Key link: Successful professional development must consider school capacity. *Journal of Staff Development, 25(1), 26-30.*

Guskey, T.R. (1995). *Professional development in education: In search of the optimal mix.* In T. Guskey and M. Huberman (Eds.), Professional Development in Education: New Paradigms and Practices, pp 114-131. New York: Teachers College Press.

Guskey, T.R., & Yoon, K.S. (2009). What Works in Professional Development? *Phi Delta Kappan*, 90(7), 495-500.

Hassel, E. (1999). *Professional development: Learning from the best.* Oak Brook, IL: North Central Regional Educational Laboratory (NCREL).

Ibrahim, M.A (2014). Professional *Development in English Language Teaching*: A Teachers' view. *British Journal of Education.* 2 (7), 32-49

Kane, T. J. & Staiger, D. O. (2012). *Gathering feedback for teaching: Combining high-quality observations with student surveys and achievement gains*. Seattle, WA: Bill and Melinda Gates Foundation.

Porter, A., Garet, M., Desimone, L., & Birman, B. (2003). Providing effective professional development: Lessons from the Eisenhower program. *Science Educator*, 12(1), 23-40.

Okoli, K. (2009). Professional development and instructional practice: Conceptions and evidence of effectiveness. *Journal of Education for Students Placed at Risk* (JESPAR), 14(1), 45-71.

Tate, M. L. (2009). Workshops: Extend learning beyond your presentation with these brain friendly strategies. *Journal of Staff Development*, 30(1), 44-46.

Vescio, V., Ross, D., and Adams, A. (2008). A Review of Research on the Impact of Professional Learning Communities on Teaching Practice and Student Learning. *Teaching and Teacher Education*, 24(1), 80-91.

Yoon, K. S., Duncan, T., Lee, S. W-Y., Scarloss, B., and Shapley, K. (2007). Reviewing the Evidence on How Teacher Professional Development Affects Student Achievement. Issues & Answers Report, REL 2007–No. 033.

INSTRUCTIONAL INTERVENTIONS USED TO DEVELOP COGNITIVE ACADEMIC LANGUAGE PROFICIENCY IN THE TEACHING OF A CONTENT AREA SUBJECT TO ENGLISH SECOND LANGUAGE LEARNERS.

Erick Nyoni

Midlands State University

nyonie@staff.msu.ac.zw

Abstract

In many African countries, the language of instruction is not the language of the home. The curriculum is mediated in English. In the majority of cases, English Second Language Learners (ESLs) have limited Cognitive Academic Language Proficiency (CALP) which is critical for academic achievement. The problem in the secondary school curriculum in Zimbabwe is that ESL learners are faced with content area discourse patterns and content area vocabulary that are unfamiliar and unique to different subject disciplines. Teaching and learning in the 21st Century should shift from content specific teaching to Language focused teaching to make content accessible to ESL learners. Limited CALP becomes an inhibition to unlocking expository information found in content area texts. Content area instruction in ESL contexts therefore becomes interventional. This paper focused on establishing instructional interventions used to develop CALP skills by a Form Three Geography teacher in a Zimbabwean secondary school. The research question was 'What instructional interventions are used by a Geography teacher to develop the CALP of ESL Geography learners. A case study design was used. Data was collected using non-participant observation and focus group interviews. Twenty-four (24) lessons were observed at the rate of 4 lessons per week making the observation period six weeks. Focus group interviews were conducted with 34 learners made up of 17 female learners and 17 male learners in the Geography class. The theoretical framework that informed this study was the theory of instructional intervention, Cognitive Academic Language Proficiency and Vygotsky's Social Cultural Theory. The study established that the teaching of ESL geography learners did not have a CALP orientation and teaching strategies were not interventional in nature. The implications of the study are that teachers have to be capacitated with instructional intervention strategies to help ESL learners with a low proficiency of CALP to develop the necessary discourse patterns to understand different content area disciplines.

1.0 Introduction

Language is critical for content area learning but English Second Language Learners (ESLs) find themselves burdened with learning in an L2 which might inhibit their comprehension of concepts. ESL learners with limited CALP proficiency find themselves face to face with unfamiliar discourse patterns that are unique to the content area disciplines that they are studying. As a result of this constraint, achievement in education is curtailed not because learners do not know but that they do not have the language with which to process concepts in the content area disciplines.

1.1 Background to the study

The secondary school curriculum in Zimbabwe is mediated in English which is a second language to the majority of learners. This is against best practice where learning should be mediated by the learner's first language (L1). Leaners have to deal with abstract thought processes across the curriculum which requires that they possess CALP. Teaching and learning in the 21st Century should therefore shift from content specific teaching to language focused teaching to make content accessible to learners to capacitate learners for any future career development in tune with UNESCO's (2014) observations that teaching should focus on specific competencies and skills needed to function effectively in the twenty-first century, and the pedagogy required to stimulate those capabilities. AACTE (2010) also makes the observation that

> today teachers are asked to achieve significant academic growth for all students at the same time that they instruct students with ever-more diverse needs. Teaching has never been more difficult, it has never been more important, and the desperate need for more student success has never been so urgent Are we adequately preparing future teachers to win this critical battle? (AACTE,2010).

Capacitation of learners with the necessary CALP skills can only materialise if teachers themselves are capacitated with strategies that close the linguistic gap between the language of the home and CALP.

1.2 Purpose of the study

The objective of the study was to establish the instructional interventions that a Geography content area teacher was using to develop the Cognitive Academic Language Proficiency

skills of a Form Three Geography English Second language learners class. The objective was formulated from the research question *What instructional interventions are used by a Geography teacher to develop the CALP skills of ESL Geography learners.*

1.3 Review of literature.

Literature abounds on the role language plays in learning as exemplified by Cohen (2014), Arnó-Macià & Mancho-Barés (2015) and Cenoz (2015). What is key in these studies is the fundamental role language plays as a medium of instruction and how it should be developed to facilitate learning. Learning though, is constrained where learning is mediated in an L2. Cummins, Mirza and Stille (2012) observe that focus on developing bilinguals' language of learning improves achievement. A study of Furgason (1959), Bernstein (1990, Sellinker (1972) and Cummins (1979) gives the insight that there are language varieties that are appropriate for formal communication in the school and there is a language variety that is appropriate for social communication outside the school. Furgason proposes a distinction between the high variety (H) and the low variety (L). For Furgason, the L is the language of social interaction and the H is the language of education. Bernstein observes a distinction between the Restricted and the Elaborated Codes. For Bernstein, the restricted code is used for social communication and the elaborated code is the variety used in the school. Sellinker propounded the interlanguage theory and sees an interlanguage as an approximative system existing between the learner's L1 and his or her L2. The insight gained from Sellinker is that learners with an interlanguage that is close to their L1 on the L1 and L2 continuum are likely to be constrained in their learning of content areas. The language of education can be synonymous to the H, the elaborated code, CALP. Teaching content in the 21st century should be seen more to focus on intervention strategies that help to close the gap between the language of the home and the language of the school which shall be referred to as CALP in the whole study. There is a scarcity of literature on studies that focus on instructional interventions that can be used to develop the CALP skills of ESL learners in Zimbabwe and this study seeks to close that gap.

1.4 Conceptual/theoretical framework

The conceptual and theoretical framework for this study is formulated on the basis of instructional intervention, CALP and Vygotskys'(1978) Social Cultural Theory. Collier

(2016) defines Instructional intervention as both a technique for and a time period during which at-risk learners receive targeted instruction to address specific learning needs. Collier (2016) goes on to explain that the term is sometimes used to refer to the time period following an indication by a teacher, or other concerned person, that the learner has some kind of learning or behaviour problem with the primary focus of this period providing learner-focused interventions that will resolve as many of the learner's difficulties as possible. These interventions will also help the instructional team to make an appropriate decision whether the diverse learner's needs are based upon unidentified disabilities or un-addressed differences in learning (Collier, 2016). A key element of instructional intervention is the implementation of specific behavioural and or curricular interventions which attempt to resolve identified learning and behaviour problems. The majority of ESL learners can be viewed as at-risk learners since the medium of instruction is not their L1. ESL learners have a specific need in that they find the L2 constraining in learning and they need learner focused interventions that 'will resolve as many of the learner's difficulties as possible'. Instructional interventions specific to CALP make content area vocabulary prominent in lessons and the teacher integrates these in the discourse patterns that are found in the content area in explicit ways. Teaching vocabulary that will help learners grow beyond the confines of their own language realms and open up the informational treasures of the worlds should be the major preoccupation of the 21st UNESCO teacher to develop CALP since CALP is directly related to IQ and to other aspects of academic achievement (Henry, 2018) CALP is distinguished from the language of the home that is context embedded and accessible by insiders who have shared meanings and constrains educational achievement where it lacks. This study gains insight in the complex nature of CALP in that it takes longer to develop especially in ESL contexts. CALP is explicit in nature and has universalistic meanings. CALP is cognitively demanding and context reduced making tasks difficult for learners. Relatively low levels of CALP proficiency are associated with cognitive disadvantages. The implications of CALP to this study is that ESL learners cannot develop CALP on their own and teachers need to intervene and develop learners' CALP skills. Vygotsky (1978) acknowledges the role of language in learning. He points out that learners can be scaffolded by the more knowledgeable others (MKOs) after the zone of proximal development (ZPD) has been identified. The teacher as the more knowledgeable other has the duty to scaffold learners to a point where they can communicate with other learners and the teacher with facility in their learning.

1.5 Methodology

A case study was conducted with a Form Three geography class and its teacher. Twenty-four (24) lessons were observed at the rate of four lessons per week for a period of six weeks. Field data were generated from classroom observation and focus group interviews with two groups of learners from a class of 34 Geography learners. Audio recordings of classroom observations and focus group interviews were used to capture the activities of the teacher and the learners during the learning of Geography. The data was transcribed and coded to establish the instructional interventions used to develop the Cognitive Academic Language Proficiency skills of the Form Three Geography class. The data was sifted through for any emerging patterns using the codes. The codes were formulated using the researcher's knowledge of instructional interventions specific to CALP. From a qualitative paradigm, Nominal data was generated to establish whether the occurrence of an intervention was high or low and the data was presented in a table. The High frequency was presented as **HIGH>12** meaning occurrence of instructional intervention use out of 24 lessons is greater than 12 and the low frequency was presented as **LOW>12** meaning occurrence of instructional interventions out of 24 lessons is less than 12. Four themes were generated and these were, how the teacher dealt with content area vocabulary, learner and teacher interactional patterns, teacher feedback, and instructional interventions specific to the development of CALP. Permission was granted from the Ministry of Education and the school. Written consent was obtained from guardians or parents of learners as well as the teacher. It was made clear to them that they could withdraw participation at any time if they so wished. No real names were used and information was dealt with in such a manner that it did not offer any leads to the identity of the participants.

1.6 Results

1.6.1 Results from the focus group interviews
How the teacher deals with content area vocabulary?

During the focus group interview learners were asked to reflect on some of the lessons they had with the Geography teacher to find out how the teacher dealt with content area vocabulary language as contained in the Geography syllabus. Learners were asked to explain how their teacher dealt with terms peculiar to Geography. The learners indicated thus:

> "T*he topic she dealt with was on weathering, first of all definitions were*

> *given,'*
>
> *' the types of weathering they were expressed in a Geographical way"*
>
> *"She writes on the board and tells us to go and research"*
>
> *"she writes words and underlines them".*

The researcher wanted to know if the teacher insisted on own definitions to which learners indicated

> *"She did that a lot but* there was the addition *that I think when you said aah are you able to change the definitions to your own simple way I, I can say its impossible why because the Geographical terms means Geographical terms and that's why you find in your books a comment from your teacher said write in a Geographical way."*

The researcher wanted to know if the teacher used charts and learners said:

> *"I rarely saw the teacher use charts"*
>
> *"If the teacher uses them I believe we would understand concepts in Geography more"*

The researcher concluded that there was an attempt by the Geography teacher to develop CALP by giving definitions of words, writing them on the board and underlining them. Best practice would mean a synergy of CALP capacitating strategies such as use of advanced organisers and graphic organisers that are compatible with graphicacy. East Carolina University (2014) indicates that advance organizers can have a profound effect on learners' success during a lesson, especially when that lesson requires them to perceive, store, and recall new information. The use of advanced graphic organisers would help learners to focus on CALP by anticipating and organizing new information at the beginning of lessons (East Carolina University, 2014). Previously gained CALP is used to enable learners to make connections between previously learnt information and new information using graphic organisers. East Carolina University (2014) states that graphic organizers form a powerful visual picture of information and allow the mind 'to see' undiscovered patterns and relationships between ideas that will help in the development of CALP. The teacher could use graphic organisers such as the Frayer's Model (1969), semantic feature analysis, hierarchy charts and timelines, cause and effect charts and Venn diagrams. The Education Department (2016) states that although there are many variations and possible combinations of graphic organizers used in the classrooms, most of them fall into four basic categories, namely cyclical organizers, conceptual organizers, sequential organizers and hierarchical organizers.

Graphic organisers by their nature are context embedded and make cognitively demanding and context reduced tasks accessible to learners. This capacitates learners with CALP that will mediate learning in Geography. Graphic organisers according to The Education Department (2016) are tools for critical and creative thinking, for organizing information, for understanding information and relationships, depicting knowledge, understanding and tools for self-learning. The researcher established that without advanced organisers and graphic organisers the teacher might be constrained in optimizing the development of CALP in the learning of Geography to ESL learners. Focus on content area vocabulary was not interventional and there were limited attempts to scaffold learners.

The next theme that emerged from the focus group discussion with the learners is the strategies used by learners to deal with the Geography vocabulary.

1.6.2 Strategies used by learners to deal with Geography vocabulary

Regarding strategies used by the teacher to enable learners to understand and use the content vocabulary, learners had this to say:

> "We use *Geography today, Physical Geography* and *Step ahead in Geography*"
>
> "*The school does not have Geography prescribed books so we buy and photocopy*"
>
> "Ah *some books like the one authored by Burnett it has complicated diagrams even the words are difficult to understand.*"

The results of the study revealed that these Geography learners used different textbooks that they were expected to buy for themselves. The use of different textbooks in the same classroom can create a barrier to learning as the same topic will be discussed differently by various authors. The results further revealed that the learners were on their own in ensuring that they understood the content learned given the fact that the teacher did not scaffold the learning of geographic specific vocabulary which could be challenging to learners. The teacher's inability to teach the necessary language resulted in learners failing to understand the content that was taught (Cummins, 1984). This implies that learners cannot develop CALP on their own but through the assistance of the teacher.

On what strategies learners used in dealing with Geography vocabulary in texts learners said:

> "*I must say like when I first read the prescribed book, and certain topic I don't*

understand but if I keep on reading the topic I would then understand."

"I benefit when I read on my own"

"If you do not understand so you would really struggle".

"Sometimes we ask the teacher, we ask what the word is if we are not actually

sure about the meaning of the word".

The results show that most of the challenges experienced by these learners result from their lack of CALP skills. This is against best practice where focus should be on scaffolding learners to develop CALP. Unfortunately for them, the teacher appears not know how to assist them through CALP intervention strategies. Furthermore, these learners appeared to be using different Geography texts which also makes it a challenge to know the type of language challenges experienced by learners at a given time. When these learners fail to understand they claim that they do repeated reading in order to understand the content.

There is a difference between the narrative text and the expository text. In reading expository texts that characterise Geography, learners are faced with literacy skills that can only be developed by the teacher's intervention in training learners how to read Geography texts, especially with skills of graphicacy. The different texts that learners would bring to supplement learner- teacher contact will be at different levels of cognitive demands with some texts tending to be more cognitively demanding than others. If the teacher does not intervene by training graphicacy skills, then, reading attempts by learners will be futile.

The section below deals with the theme 'interactional patterns'.

1.6.3 Interactional patterns

The study looked at interaction patterns that were taking place in the Form 3 Geography class that either assisted or hindered the understanding of Geography. Among the interaction strategies used are group work, and learners indicated that during such discussions they codeswitched between Shona and English. Learners had the following to say:

"We sometimes work in pairs or groups. "

"It was difficult to interact with other learners using English because I

feared they will laugh at me if I make mistakes"

With regard to the language mostly used by learners during group discussion, the learners stated that:

"Shona and English but Shona seems to be used more."

> *"We need more time to talk for us to learn but the teacher talks most of*
>
> *the time except when we have a test (laughter)"*

Although group work is used, it is not mostly used as indicated by the learners in the quotation below:

> *The teacher asks us to work alone many times."*
>
> *"Sometimes when the teacher says go into groups some learners talk*
>
> *about things at home in Shona."*

I established that the interactional patterns are CALP oriented, especially when learners work in groups or pairs. The importance of group work in developing learners' CALP skills is also emphasised by Cummins, 1984, 1978, 1999). The importance of scaffolding by either peers or knowledgeable others is further emphasised by Vygotsky (1978). What appears to be working against the development of learners' CALP skills is the teacher dominated lesson. Learners are therefore not given enough opportunities to be actively involved in their learning through interacting with their peers.

The next theme relates to teacher feedback.

1.6.4 Teacher's feedback

Assessment is a critical component in teaching, as it provides the teacher with information on learners' understanding of the content. Through assessment, teachers are able to identify struggling learners and lastly they know what works and what does not work as such they are able to modify their own teaching where necessary. The learners stated the following with regard the feedback they received from their teacher:

> *"I don't think she pays attention to grammar mistakes because my*
>
> *English is bad".*

However, this in contrast with this other learner below who says

> *"she pays attention on the language of Geography and she uses*
>
> *Geography terms."*

Judging from what learners said about assessment, I conclude that feedback that they receive shows that they are being guided to develop CALP in the learning of Geography though in a limited way. According to Cummins (1989), limited time is required to acquire BICS skills but it takes six to 10 years of being immersed in a language to acquire CALP, which is essential for academic success. It is therefore essential that the teacher uses intervention strategies to teach CALP. The teacher further needs to provide learners with quality feedback

to assist them in mastering the Geography content.

1.6.5 Strategies used by the teacher to help learners remember concepts in Geography

Learners were asked what strategies they used to remember, store and retrieve information and the following was indicated:

> "A*ah as for me I pray even when I read, I pray before I read then after I read then close with a prayer so for me am a religious person so I pray so that I can remember."*
>
> "*I use sort of abbreviations, aaah but it's difficult.*
>
> *"It's like I read after that I get a piece of paper and write an essay of what I was reading".*
>
> *"As for me I firstly read and I close the book and I start asking myself questions and then answering them and where I don't understand then I refer to the book and then I close it"*
>
> *"When I read, I explain to my peers like I can talk to my friends and explain and if you continue talking about something the more you understand."*

The data revealed that some learners used mnemonics to help them to remember concepts. The results further indicated that the teacher did not teach mnemonics to assist her learners to remember the content taught and as such these learners were expected to devise their own means to assist themselves in remembering the content. The teacher, however, did provide them with notes and but did nothing in teaching them how to make their own notes. She therefore failed to use graphic organisers or semantic maps, which can be useful in helping learners make sense of what they are learning.

There was the general agreement from the learners that the teacher always emphasised that learners revisit their notes. The major finding is that the teacher was not explicit about the strategies that the learners could use to store and retrieve information in the learning of Geography except to ask learners to commit themselves seriously to the reading of their notes which has little effect on the development of CALP. This would not be the best way for learners to store and retrieve information. What they needed was developing the skill to use graphic organisers that make cognitive academic language specific to Geography conspicuous.

The section below will present and discuss the study findings from observations conducted.

1.6.6 Findings from lesson observations

Table 1.1 Intervention strategies used to develop Cognitive Academic Language proficiency in the teaching of Geography to English Second language learners

Codes	The teacher:	Frequency Of occurrence out of 24 lessons	
		LOW>1 **2**	**HIGH<1** 2
WLO	Wrote language objectives clearly for learners	✓	
WCO	Wrote content objectives for learners	✓	
EKV	Emphasised key vocabulary	✓	
SA	Adapted speech to suite learners' proficiency levels		✓
PSI	Provided explicit instruction	✓	
TDI	Identified task difficulty to adjust instruction	✓	
Release	Shifted the responsibility for learning from the teacher to the learners.	✓	
C	Cued learners	✓	
PROB	Probed learners		✓
P	Prompted learners		✓
M	Modelled concepts	✓	
D	Lead discussions		✓
Q	Provided learning through questioning		✓
RC	Asked questions and requested clarification as well as offer praise and encouragement		✓
ZPD	Began with what the learners could do (ZPD)		✓
WC	Watched for clues from learners that show when and how much teacher assistance is needed		✓
ITS	Provided opportunities for interactions and discussion		✓

	between teacher and learners		
ISS	Provided opportunities for interaction and discussion among learners	✓	
ER	Encouraged elaborate responses	✓	
HO	Provided hands-on materials and/or manipulatives for learners to practice using new content knowledge.	✓	
PACA	Provided activities for learners to apply content and language knowledge in the classroom.	✓	
IL	Provided activities that integrate all language skills (i.e., reading, writing, listening, speaking).	✓	
SLO	Supported language objectives clearly.	✓	
ENGA	Engaged learners approximately 90-100% of the time (most learners taking part/on task). Pace the lesson appropriately to the learners' ability level	✓	
RCV	Gave a comprehensive review of key vocabulary	✓	
QM	Explicit use of the Four Quadrant Model by Frayer	✓	
SFA	Explicit use of semantic feature analysis	✓	
BAV	Explicit use of Building Academic Vocabulary	✓	
CVI	Explicit use of Contextualised Vocabulary Instruction	✓	
MCVI	Explicit use of the Multifaceted Comprehensive	✓	
P	Vocabulary Instructional Program		
CS	Code switched/ code mixed		✓
CB	Used Chalkboard		✓
Charts	Used charts		✓

.

The findings from lesson observations revealed there was low frequency on writing content objectives and language objectives for the lessons as suggested by Kareva and Echevarria (2013:240) in the Sheltered Instruction Observation Protocol (SIOP). These authors point out that the focus for each SIOP lesson is content and language objectives that are clearly defined, displayed, and orally reviewed with learners. Focusing on content objectives and the attendant language objectives for a particular lesson would make learners discern the abstract thought processes that would otherwise be impossible without the requisite technical terms. If the language objectives are clearly stated and the teacher focus on the language, then, the

learners' CALP skills will be enhanced so will be their understanding of the content taught (Cummins, 1999).

There was a low frequency of emphasis on the key vocabulary items in the lessons observed. Key vocabulary items should be emphasised, as there is a relationship between language and the thought processes involved in the learning of Geography for CALP to be developed. Kong (2015) indicates that there are thought processes that are not possible without appropriate language for those thought processes.

The teacher, however, adjusted her language to the level of the learners with clarity of explanation and frequency of adjusting language was high. This helped the learners to understand the content. Use of explicit instruction had a low frequency in an attempt to explain key vocabulary during the lessons.

In setting up both class work and homework exercises, Cummins' (1999) framework did not feature much as past exam papers were used during the first term. The exercises which were prepared for the learners were cognitively demanding and context reduced, making the tasks very difficult (Cummins, 1984). Context reduced and cognitively demanding tasks challenged learners who were not familiar with the discourse patterns requisite in the learning of global pressure belts and air masses in particular. An analysis of learners' record of marks revealed that learners were not coping, as their performance was dismal.

The lessons were also teacher dominated to an extent that it had a high frequency out of 24 observations made in which learners were given an opportunity to participate in their own learning. For learners' CALP skills to be developed, they need to be actively involved in the classroom (Cummins, 2013; Krashen, 1989 and Vygotksy, 1978). The teacher concentrated more on cueing as indicated by the high frequency. This implies that in each of the lessons observed, the teacher made use of this strategy. The teacher also used probing to assist learners with the understanding of the Geography content as indicated by the high frequency out of 24 lessons observed. Although learners appeared to be benefitting from this strategy it was not enough as can be attested by their poor performance in the written tests. The teacher did not use any modelling during instruction and as such, an opportunity was missed to assist these learners to understand the content taught. Judging by the norminal data presented in in

Table 1.1 frequency of strategies that would be interventional in nature is low implying that the language needs of the learner are not being addressed.

1.6.6 Discussion of findings

The study was to establish the Instructional interventions used to develop Cognitive Academic Language proficiency in the teaching of content area subjects to ESL learner. It was not possible to deal with all the content areas that were offered in the school curriculum. Studies of more content areas could be done to gain more insight into the instructional interventions used to close the gap between the language of the home and the language of the school to improve educational achievement of ESL learners. Six themes emerged from the study, that is, how the teacher dealt with content area vocabulary, strategies used by learners to deal with Geography vocabulary, interactional patterns, teacher's feedback, strategies used by the teacher to help learners remember concepts in Geography, instructional interventions used to develop Cognitive Academic Language proficiency in the teaching of Geography to ESL learners. The themes gave a wide view from which findings could be discussed.

From the focus group interviews, the study established that the manner in which content area vocabulary was developed in the learning of Geography did not help much to close the gap between the language of the home and the language of the school to help learners comprehend content. Vocabulary instruction is key for educational achievement as corroborated in studies by Fisher, (2014). Alvermann, Gillis, and Phelps (2013) and Beck, McKeown, and Kucan (2013). There was more of content specific teaching. Findings from these studies emphasise the need to be responsive to the needs of learners to scaffold learners with the necessary CALP to a level where they can discuss concept with facility.

From the focus group interviews learners revealed inadequacies in how they dealt with content area vocabulary. Graves (2016) articulates the need to develop strategies that learners can use to develop CALP. Responses from the focus group interviews indicated no reference to word learning strategies, word parts, context clues, recognising multiword units, strategies for dealing with unknown words, developing approaches to building vocabulary as indicated by Graves (2016). Graves indicates that there is need for the development of word learning strategies in an explicit way but the Geography teacher did not develop vocabulary learning strategies in an explicit way hence the limited CALP in the learners and for Beck and Kucan

(2013) instruction has to be robust to meet the needs of learners. According to Fisher and Frey vocabulary is a predictor of learner's overall comprehension. The study indicated that teacher feedback did not have a CALP orientation. Lee (2014) points to the limitations of teacher feedback where it is pointed out that feedback should mediate learning. Comments made in the learner's exercise books did not help much to develop the CALP of the ESL learners that would mediate their learning. The interactional patterns did not provide for more knowledgeable others in the class to help struggling learners. There was more of individual work with collaborative learning not taking a critical role. There was very little learner –learner interaction and the teacher dominated discourse in the learning process. Lee and Buxton (2012) notes that a major challenge for teachers is how to structure activities so as to reduce the language load required for participation while maintaining the rigor in content learning processes. They add that effective feedback means recognising ESLs' varying levels of language proficiency and adjusting their interactions with students accordingly.

Data from observation clearly indicated that there was a low frequency instructional interventions that aimed at improving the CALP skills of the ESL learners in an explicit way. The findings were that though the teacher had adequate knowledge of content, the teacher was oblivious of the many strategies of developing CALP such as those propounded by Kareva, and Echevarria, (2013) such as lesson preparation, Building Background, Comprehensible Input, Strategies, Interaction, Practice and Application, Lesson Delivery and Review and Assessment.

1.7 Conclusions

The study aimed to establish the instructional interventions used in developing the CALP capabilities of a Form Three ESL Geography class. The analysis of data from the focus group interviews lead to the conclusion that learners were struggling with geography concepts during lessons and during their own reading. Learners did not benefit from an explicit instruction of the critical vocabulary that will help learners to access content and talk about content with facility Judging by the focus group interviews feedback from the teacher did not help much in scaffolding CALP. Learners did not benefit much from the teachers' attempt to develop CALP. Learners though indicated that definition of terms was done and key words

were highlighted. There was no use of graphic organisers. The analysis of the case study data gathered from observing the teacher in 24 lessons lead to the conclusion that instructional interventions to help learners develop CALP were noted in the form of adapting language to the level of learners, probing, prompting learners and asking questions. Developing of CALP was also seen in identifying learners' ZPD, watching for clues, teacher pupil interaction, code switching, use of the chalkboard and charts. The teacher though was oblivious of strategies such as writing of language and content objectives. There was lack of emphasis on key vocabulary and provision for explicit instruction. The teacher was oblivious of the task difficult index that lead her to her giving cognitively demanding work before learners were ready for it. No encouragement for elaborate responses was made. No opportunities were provided for applying content knowledge. The final conclusion made is that there is a knowledge gap in the teacher on the strategies that can be used to close the gap between the language of the home and CALP.

1.8 Recommendations

This paper recommends that:

➢ Learners should be taught content area vocabulary explicitly.

➢ Interactional patterns in an ESL classroom should facilitate the development of CALP.

➢ The nature of feedback should be such that content area vocabulary is scaffolded.

➢ Content area building strategies should be natured in learners.

➢ Teachers should be capacitated to develop CALP during training.

➢ In-service training should be provided to close the knowledge gap that might result from lack of exposure to current trends and research in the development of CALP.

➢ Schools should come up with explicit policies on the development of CALP for ESL learners.

➢ The Ministry of Education should come up with policies that focus instructional intervention for learners who are at risk.

➢ There is need for further research on instructional interventions in other content area subjects so that there can be d holistic understanding of how ESL learners can be assisted to develop CALP

REFERENCES

Alvermann, D. E., Gillis, V. R., & Phelps, S. F. (2013). *Content area reading and literacy: Succeeding in today's diverse classrooms*. New York, NY: Pearson.

Arnó-Macià, E., & Mancho-Barés, G. (2015). The role of content and language in content and language integrated learning (CLIL) at university: Challenges and implications for ESP. *English for Specific Purposes*, *37*, 63-73.

Bernstein, B. (1990) *The Structuring of Pedagogic Discourse*: Vol. 4: Of Class, Codes and Control (London, Routledge)

Cenoz, J. (2015). Content-based instruction and content and language integrated learning: The same or different? *Language, Culture and Curriculum*, *28*(1), 8-24.

Cohen, A. D. (2014). *Strategies in learning and using a second language*. Routledge.

Collier, C.2016. Instructional Intervention Planning & Review (IPR) Manual & Forms Cross Cultural Developmental Education Services.

Cummins, J. (1979) Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. Working Papers on Bilingualism, No. 19, 121-129.

Cummins, J., Mirza, R., & Stille, S. (2012). English language learners in Canadian schools: Emerging directions for school-based policies. *TESL Canada Journal*, *29*, 25.

Ferguson, C. A. (1959). Diglossia. *word*, *15*(2), 325-340.

Fisher, D., & Frey, N. (2014). Content area vocabulary learning. *The Reading Teacher*, *67*(8), 594-599.

Henry, J. (2018). Elementary English for Speakers of Other Language Teachers' Perceptions of the Push-In Program to Support Mathematics Skills.

Krashen, S. D. 1985. *The input hypothesis: Issues and implications*. Addison-Wesley Longman Ltd.

Lee, O., & Buxton, C. A. (2013). Integrating science and English proficiency for English language learners. *Theory Into Practice*, *52*(1), 36-42.

Luna Scott, C. (2015). The futures of learning 2: What kind of learning for the 21st century? Available from http://unesdoc.unesco.org/images/0024/002429/242996E.pdf accessed on 28 August 2018.

Meyer, O., Coyle, D., Halbach, A., Schuck, K., & Ting, T. (2015). A pluriliteracies approach to content and language integrated learning–mapping learner progressions in knowledge construction and meaning-making. *Language, Culture and*

Curriculum, *28*(1), 41-57.

Selinker, L. (1972). Interlanguage. *IRAL-International Review of Applied Linguistics in Language Teaching*, *10*(1-4), 209-232.

Vygotsky, L. (1978). Interaction between learning and development. *Readings on the development of children*, *23*(3), 34-41.

Kareva, V., & Echevarria, J. (2013). Using the SIOP model for effective content teaching with second and foreign language learners. *Journal of Education and Training Studies*, *1*(2), 239-248.

THE NATURE OF MATHEMATICS TEACHER KNOWLEDGE FOR PRE-SERVICE TEACHERS IN ZIMBABWE

Chipo Makamure[1] & Loyiso C Jita[2]
[1]Belvedere Technical Teachers' College

[2]University of the Free State, South Arica

makamburec@gmail.com[1]; jitalc@ufs.ac.za[2]

Abstract

This study was primarily founded on the premise that teacher knowledge determines learner attainment in mathematics. However, regardless of the overwhelming research on mathematics knowledge for teachers, the problem of mathematics underachievement in high schools has not been resolved. It is argued that teacher knowledge is largely determined by cultural dynamics, which makes it difficult to establish the nature of mathematics knowledge that suits all pre-service teachers (PST) to teach mathematics effectively. Based on this reason, this study investigates the way college and field experiences of pre-service teachers in Zimbabwe can account for the kind of mathematics teacher knowledge that is crucial for success in secondary school mathematics. The mixed methods approach was used to collect and analyse data. The study uncovered a disturbing imbalance between the focus on mathematics content on the one hand, mathematics pedagogy and the curriculum knowledge on the other, among pre-service teachers. The study recommends that effective teaching of mathematics requires pre-service teachers to approach mathematics teaching in a holistic manner where one component of teacher knowledge does not transcend another.

Keywords: Mathematics teacher knowledge, Pre-service teachers, teaching practice.

1. INTRODUCTION AND BACKGROUND

This study is premised on the concept that success in secondary school mathematics is related to mathematics knowledge for teaching that the teacher possesses. This knowledge is largely governed by cultural dynamics, which make it hard to determine the nature of mathematics knowledge that is suitable for all pre-service teachers (PST) (Kim, Ham & Paine, 2011). Therefore, there is need to conduct a study in the context of Zimbabwe, regarding what mathematics knowledge teachers need to boost student achievement in the country. According to Kessel (2009), mathematics teacher knowledge is an application of mathematics

to the practice of teaching. Hence, the subject matter knowledge of a teacher and knowledge of learners determine the tasks assigned to the students, the learning setting, learning process perception and the adjustment of the initial plans to suit reality (Steinbring,1998). However, researchers have contrasting perspectives on what teachers need to know and do about mathematics to teach it effectively. Borko et al. (2000) cite several studies that have made suggestions that teachers with less content knowledge normally emphasise facts, rules and procedures rather than conceptual problem-solving aspects of learning. Shulman (1987) also advocates that instructional programmes in mathematics ought to focus on learning to reason as part of mathematics understanding. However, though researchers appreciate teachers' mathematical knowledge, they are sceptical about its achievement of its purpose of leaner attainment in mathematics. A number of studies have shown that mathematics knowledge for teachers is thin and weak and this has hampered effective teaching (Ball et al., 2005). From several studies that were conducted on teacher knowledge, Ball et al. (2005) find that the debate around teacher knowledge needed for mathematics teaching remains devoid of any solution. The study, therefore, investigates how the campus and field experiences of PST can shape their mathematics knowledge to expertly teach mathematics in a way that begins to address the performance deficits in Zimbabwean secondary school mathematics. The study therefore, seeks to address the following research questions: What do PST learn about mathematics and mathematics teaching before and during teaching practice (TP) in Zimbabwe? How do PST learn about mathematics and mathematics teaching in Zimbabwe?

2. THEORETICAL IMPLICATIONS

This study is premised on the concept of "learning to teach" mathematics. Learning to teach is viewed as a process of acquiring knowledge about teaching and then applying it in the field (Makamure & Jita, 2017). With regards to "learning to teach", Shulman (1986) has been influential in clearly spelling out what teachers need to know about "what to teach" (the content knowledge) and "how to teach" (the pedagogy). Cochran, DeRuiter and King (1991), on analysing Shulman's view of PCK, posits that PCK capacitates the mathematics teacher to disseminate subject knowledge to the learners because the teacher's comprehension of the subject matter is of no value if it cannot be communicated to the students. It is this knowledge that marks the difference between a mathematics specialist and a mathematics teacher. To reinforce Shulman's theory, Grouws, Howald and Colangelo (1996) developed a theoretical

framework of mathematical perceptions for teachers, which may impact the PSTs' teaching knowledge of mathematics during learning to teach. For this study, the pertinent issues of the framework need to be unpacked. The framework points to the perceptions about the nature of mathematical knowledge, the character of mathematics activity, the essence of learning mathematics and the usefulness of mathematics. The PSTs' knowledge about these may determine their approaches to teaching. For instance, the essence of learning mathematics demonstrates whether mathematics should be memorised or understood. It also involves whether mathematics is about finding correct answers or following procedures (Grouws et al., 1996). Therefore, PSTs who perceive mathematics in this traditional manner (direct transmissions) are likely to hold conceptions that knowledge is certain and unchanging (Organisation for Economic Cooperation and Development, 2009), which will also determine their approach to teaching. Hence, it is pertinent in this study to investigate the issues that develop mathematics knowledge for PSTs during learning to teach.

3. LITERATURE REVIEW

Mathematics teacher knowledge

The purpose of the study is to ascertain the influence of the campus and field experiences on the development of the PSTs' knowledge for teaching mathematics. For the purpose of this study, it is essential to unravel the different kinds of knowledge crucial for teaching mathematics.

Content knowledge

Shulman (1986) identified different types of mathematics knowledge for teachers. Shulman refers to content knowledge (CK) as the quantity and organisation of the subject matter knowledge of the teacher. Consistent with this definition, mathematics content knowledge consists of knowledge of the concepts that include definitions and principles (conceptual knowledge) and knowledge of the sequences, algorithms and procedures in problem solving (procedural knowledge) (Shulman, 1987).

However, it is still disputable whether the teachers' content knowledge has a direct effect on students' achievements. Several studies have shown that many teachers lack content knowledge in teaching mathematics (Hurrell, 2013). As a result, many prospective teachers

exhibit weaknesses in showing confidence when teaching mathematics. On analysis of these ideas, PSTs can hardly deliver if they lack mathematics content knowledge because people may not be able to give what they do not have. Kessel (2009) hence suggests that teachers need to be able to solve problems and to present solutions to the students with confidence if effective teaching is to take place.

Pedagogical content knowledge (PCK)

Shulman (1986) also identifies the concept of pedagogical content knowledge (PCK) which Richardson-Koehler (2011) regards as the intersection of content and pedagogy. PCK, according to Koehler (2011), provides an understanding of the mathematics to teach for PSTs, that is, the teaching strategies to be used with certain kinds of learners, particular topics and different learning settings. To this end, teaching expertise for PSTs may be enhanced. An, Kulm and Wu (2004) posit that PCK has three integrated components of productive instruction in mathematics, namely, curriculum knowledge, content knowledge and knowledge of teaching.

According to Shulman (1987), previous researchers viewed and treated subject knowledge and pedagogy as mutually exclusive bodies of knowledge in teacher education. This view resulted in most teacher preparatory programmes paying attention on either one but not both. Universities and teacher training colleges should therefore contribute plenty to the development of PCK (Kleickmann, Richter & Kunter, 2013).

Mathematics knowledge for teaching (MKT)

PCK was refined into mathematics knowledge for teaching (MKT) which established the link between pedagogical content knowledge (PCK), content knowledge (CK), teachers' instructional behaviour and students' learning outcomes (Ball et al., 2005). In line with this, Depaepe et al. (2015) interprets knowledge of subject matter for teaching as consisting of knowledge of instructional strategies and representations as well as knowledge of students' misconceptions. This suggests that the teachers' capacity to use appropriate teaching approaches to make information accessible to the learners implies knowledge for teaching mathematics.

Whilst PCK is concerned about content first and how it can be modified into teachable aspects, MKT explains the idea of knowledge for teaching or knowledge in teaching and not

knowledge on teachers (Ball et al., 2008). This shows that MKT is concerned about "teaching mathematics" which is how to present a mathematical task to the learners, showing them how to solve the task, answering learners' questions, how to correct errors and explain procedures without ruling out the subject matter knowledge.

For example, the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ can be better understood by solving the general quadratic equation $ax^2 + bx + c = 0$ from the first principles using the process of completing the square.

Research in mathematics education (Ball et al., 2005) has also revealed that the kind of teaching that develops mathematical connections in learners' minds is the mathematics knowledge that is deep and connected (relational understanding). For example, knowledge of Pythagoras' theorem may assist learners to understand and find values of the basic trigonometric ratios of angles 30^0, 60^0, for instance, $\tan 60^\circ = \sqrt{3}$, or $\sin 30^\circ = \frac{1}{2}$ as shown below instead of memorising.
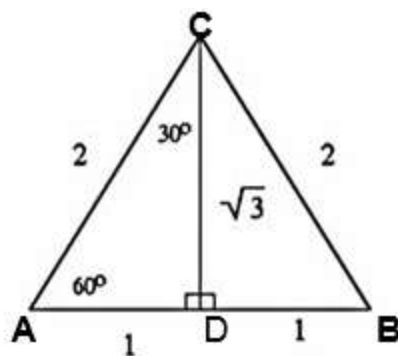
Figure 1: Trigonometrical ratios

Borko et al. (2000) also suggest that mathematics tasks should connect with the children's real world. For example, teachers' mathematical knowledge of teaching should enable them to assess the learners' cultural background before generating a word problem in algebra. Word problems involving, for example, the "two of hearts" (of playing cards) for students who are not conversant with these terms become meaningless. Such problems hide the conceptual foundation of algebra for these learners and are susceptible to hindering their understanding of the topic. If familiar terms or local games are used in the example, then they may be able to understand and see the importance of learning algebra.

Adler (2005) posits that unlike mathematics specialists, mathematics educators need to equip PSTs with the skills to analyse problems that emerge in the classroom so that they understand their learners better. For instance, after asking the students to solve a problem like -3(x + 2), the PST may be faced with the following answers from the students: -3(x + 2) = -3x + 6, or -3(x + 2) = (x + 2) − 3. Realising that the answers are right or wrong is not adequate for teaching. The teacher should be able to do the procedures and ascertain the root of the problem (Richardson-Koehler, 2011). In the first case, the learner has challenges with expanding the brackets. The negative sign outside the brackets has only affected the first number inside the bracket and the other term maintained its sign. In the second case, it seems the student has the knowledge of 'commutativity in multiplication'. The student imagines starting with -3 multiplied by the bracket, as the same as multiplying the bracket by -3 (-3 coming after the bracket). The student envisages it as if the meaning of the expression has not changed, yet the addition concept has subsumed multiplication. It may not be possible for PSTs to teach these operations if they do not understand where the problem is culminating from.

These examples suggest that teaching mathematics is a skill that every PST must acquire. Content alone is of limited importance and serves as a basic minimum qualification. Hine (2015) thus, recommends that mathematics teachers need not be able to calculate problems only but to know how to deliver and communicate the concepts to the learners for understanding. In the same context, Moore (2005) proposes that PSTs must become mathematically proficient so that they are able to teach learners who also become mathematically proficient. Hence the study seeks to establish the extent to which PSTs are knowledgeable about what and how mathematics can be taught effectively.

4. METHODOLOGY

Research Paradigm and Design

The pragmatist view of knowledge determined the selection of the mixed methods approach to collect and analyse data. Pragmatism is a philosophy which believes in action or practice (Cucu & Lenta, 2014). This study fits well in the tenets of pragmatism because it has an interest to establish the nature of mathematics teacher knowledge through practice during learning to teach. The mixed methods approach was ideal for the pragmatist ideology

because it explores concepts from more than one worldview, thereby making it more practical in terms of impact and outcomes (Creswell, 2014). In this study, the mixed methods design depicted the actions, activities, practices and perceptions of the participants that determine the mathematics knowledge for PSTs during learning to teach.

Sampling and Data Collection Procedures

Purposive sampling was designed to collect data from participants. To this end, PSTs, school-based mentors and college lecturers who I thought would provide the desired information were selected. 120 PSTs answered two different sets of questionnaires before and during TP to gather information about their college experiences, whilst 42 school-based mentors had a separate questionnaire to gather information on their experiences with PST on TP. Follow-up separate interviews were conducted with 7 college lecturers, 22 PSTs and 14 school-based mentors from the same group that answered questionnaires. The interviews focused on how and what PSTs reportedly learn about mathematics content and mathematics teaching during learning to teach.

Data Analysis Procedures

Descriptive statistics were used to analyse data from questionnaires. A 5-point Likert scale with SD (Strongly Disagree) taking the lowest scale of 1 was used to present the participants' responses that included frequencies, means, standard deviations and percentages. The questionnaires were tested for reliability using the Cronbach's alpha coefficient. The coefficients were found to be 0.614, 0.850 and 0.758 for the first, second and third questionnaires respectively. According to Yong, Hua & Feng-Mei (2007), a coefficient of $0.6 \leq \alpha \leq 0.7$ is still considered "acceptable" for the content of an instrument. The coefficients above 0.7 indicate a strong estimation of reliability. Audio recordings were also used to meet the criteria of interview credibility. The results indicate that the instruments were highly reliable. Open-ended questions from questionnaires and interviews were grouped into related themes and explained. Some of the themes that emerged from the interviews were; knowledge of teaching, knowledge of the subject matter and knowledge of the learners.

5. RESULTS AND DISCUSSION OF FINDINGS

Pre-service Teachers' Knowledge of Mathematics Content

Table 1: Pre-service teachers' mathematics content knowledge during teaching practice (Questionnaire 2)

NO	ITEMS	N =	D	N	A	Mean	S.D.
57	The course work material covered enough content that helped me to teach well during teaching practice	104	24.1%	7.7%	68.3%	3.57	1.275
58	I have adequate knowledge about the mathematics content I teach	105	8.6%	9.5%	81.9%	4.10	0.96
59	I can think mathematically	105	1%	18.1%	80.9%	4.17	0.753
60	I have different ways of improving my understanding of mathematics	104	1.9%	5.8%	92.4%	4.24	0.646
61	"A" level mathematics content is enough for a teacher to teach up to "O" level	103	17.5%	17.5%	65%	3.78	1.22
63	The mathematics content in the classes that I teach is difficult	105	81.9%	8.6%	9.6%	1.83	1.033
64	After qualifying as a teacher, I will prefer to teach mathematics at junior level (Forms 1 & 2)	103	61.2%	14.6%	24.3%	2.4	1.294
65	After qualifying as a teacher, I will prefer to teach mathematics at "O" level (Forms 3 & 4)	104	9.6%	15.4%	75%	4.10	1.128
	Total average					**3.524**	**1.039**

Results from table 1 indicate that PSTs were satisfied with the mathematics content knowledge they had, as shown by the mean scores that are all above 3.5. Items 63 and 64 have low means that reflect positive responses with regards to mathematics content knowledge. It is critical that pre-service teachers are acquainted with the content knowledge

of the mathematics subject levels they need to teach, because teachers cannot deliver the knowledge that they lack. On the contrary, the interviews with mentors yielded a different idea. First, the classes allocated to pre-service teachers during TP may be indicative of their lack of content. There was concurrence among mentors that they assigned pre-service teachers to teach junior forms and none of them was trusted with "O" level classes. One mentor (M2) had the following to say,

"……Normally we get student teachers from college "a". When they come here, we give them forms 1 and 2. No, we don't give them form 4s, usually when they come for TP, we are saying they are not yet fully prepared."

In summary, M2 appears to suggest that PSTs do not have the requisite knowledge to teach the senior classes. If PSTs practise teaching with lower level classes (forms 1 and 2 only), their mathematics teaching performance may be inadequate to cope with higher-level classes. This problem may even creep into their post-training professional lives,

Secondly, it is evident from the way PST were unwilling to teach senior classes, that they were sceptical about their mathematics content knowledge. Another mentor, M3 said:

"Some of them do not have content knowledge. …. it's like when they come they always say, from the college we were told to teach forms 1 and 2 not forms 3s and 4s."

This could be evidence of a lack of confidence about the PSTs' content knowledge, especially given the fact that in the interviews with the college lecturers, the idea of specifically assigning PSTs to forms 1 and 2 only was refuted. On the other hand, some mentors take the view that what PSTs are taught in college is perhaps divorced from what they are expected to teach in schools, which leaves the PST s with no confidence to teach "O" level work. M6 expressed his feelings about this issue as follows:

"PST have problems with their content. They have no confidence. What they are taught at college has no link with what they teach here, because they are doing "integration" there, they come here they want to teach "transformations".

The one point that the mentor seems to highlight in the above speech is the need to call for better articulation between the training college curriculum and the school curriculum.

(i)   In response to the question that required them to confirm if the college syllabus was adequate to prepare PSTs for TP, 57% of the lecturers indicated that there is need for PSTs to have knowledge of the mathematics they were going to teach in secondary school, knowledge

of the curriculum and advanced mathematics knowledge to enrich their content knowledge. The responses of some lecturers were as follows;

Lecturer 3 reiterated, "Actually we would want them to have sound deep knowledge about the subject content that they are going to teach. They should know in depth or extensively the content they are going to be teaching in schools. They should know the syllabus, everything that is in the syllabus, they should be knowledgeable ..." and Lecturer 4 added;

"I think so far, we have been trying but we realised we are making a mistake of leaving the core mathematics, which is mathematics up to "O" level. Normally our students have got areas of difficulty which they normally face when they go for TP. They need to know this to enhance their confidence."

Lecturer 4 strongly feels that the inclusion of form 4 content in the college syllabus may improve confidence in the PSTs to deliver a lesson to the learners. It is conceivable that there are mathematics topics that the PSTs may not have done well on themselves at "O" level and these require that they focus and improve on them before they stand in front of their classes as teachers. An analysis of the timetables and college syllabi against the school syllabus also shows that indeed there are few "O" level topics covered by first year PSTs before they go on TP.

Knowledge about mathematics teaching

Table 2 summarises the PSTs' concerns about the most effective ways to ensure teaching of mathematics knowledge to the students.

Table 2: Pre-service teachers' views

	ITEMS	N =	At least disagree	Neutral	At least agree	Mean	S.D.
51	Knowing mathematics involves the ability to remember formulas and procedures	104	24.1%	22.1%	53.9%	3.33	1.186
52	The textbook is the best resource to use when teaching mathematics	104	31.7%	30.8%	37.5%	3.03	1.092
53	The role of the mathematics	104	16.4%	7.7%	76%	3.85	1.147

		105	83.8%	8.6%	7.6%	1.81	0.955
	teacher is to transmit knowledge and ensure that the learners have received this knowledge						
54	**Correct answers are more important than the method used to obtain them**	105	83.8%	8.6%	7.6%	1.81	0.955
	Total average					3.005	1.095

From Table 2, the PSTs' responses show that they accept and believe that procedures used to solve a problem reflect the level of understanding a concept (item 54), although they still believed that knowing mathematics involves the ability to memorise formulae (item 51). Hence, the PSTs' feedback communicates the belief in traditional ways of teaching (item 53), where knowledge should be transmitted from the teacher to the student. This belief is likely to impact on the teaching approaches used to teach mathematics in the classroom. The interviews with PSTs revealed that many of them seemed to have a repertoire of strategies for teaching mathematics but still needed to learn the details of how and when to apply them during the actual teaching process.

Questionnaire 3 for mentors shows that while PSTs knew their content (item 17), they may still be falling back in terms of pedagogy (Item 19, mean = 3.95). To support this finding, the interviews also did pick up on the PSTs' challenges in disseminating the knowledge to the learners. Here is how M14 put it;

"Their subject knowledge is quite good. But the problem that they face is the implementation, how to explain to the pupils. You know, as a teacher with experience, that's how you learn."
M14 raises the issue of PSTs' lack of PCK. In fact, the general sentiment among the mentors seems to be that the PSTs struggled more with content delivery than with the content itself. The importance of PCK in "learning to teach" was stressed by Shulman (1986) in his treatise of the need to amalgamate subject content and pedagogy during teaching. Van Es and Conroy (2009) also argue that while teacher education programmes earnestly and persistently attempt to assist PSTs to understand the core dimensions of mathematics teaching, research shows that most of the PSTs are unable to teach mathematics for understanding. Teaching mathematics for conceptual understanding involves knowledge of and proficiency with mathematical concepts and procedures and the ability to enhance critical thinking and make

sense of mathematics (Van Es & Conroy, 2009). Hence, PSTs should have both knowledge of the content and knowledge of teaching it.

The interviews with the college lecturers revealed that although all the lecturers appreciated mathematics education in the syllabus, they seemed to pay more attention to subject content. The American Mathematical Society (2012) defines mathematics education as an interdisciplinary enterprise that requires knowledge of teaching and learning and knowledge of mathematics. The lecturers highlighted that mathematics education had very little time on the timetable. The following remarks by Lecturer 3 illustrate the lecturers' views on this issue.

"...I also feel that mathematics education is not given enough time because even the students themselves, they think mathematics content: pure mathematics, statistics, and mechanics are more important than mathematics education. Even the timetable gives them that view…"

The college lecturers who participated in this study confirmed that mathematics education was allocated four hours per week compared to twelve hours for content courses. The evidence suggests that mathematics education does not get much attention at college level. As Wu (2014) explains, content knowledge alone is inadequate to be a good teacher. This explains why Weimer (2008) posits that to envisage mathematics content as more important than the process of learning it (pedagogy), is like considering a car as more important than the road, of which these two must work together for better performance.

Does mathematics content knowledge mean the ability to teach it effectively?

Table 3 attempts to answer the question above by presenting PSTs' responses on this subject (items 49 and 50, Questionnaire 2).

Table 3: Mathematics content knowledge And the ability to teach it

ITEM	N =	Disagree	Neutral	Agree
49. Mathematics teaching at "O" Level is more effective if a teacher has more content knowledge	103	(55) 53.4%	(22) 21.4%	(26) 25.3%
50. Knowing mathematics and the ability to teach it cannot be	103	(28)	(13)	(62)

| | | 27.1% | 12.6% | 60.2% |
| **separated** | | | | |

Table 3 confirms that mathematics content knowledge and the ability to teach it are intertwined. Ball et al. (2005) thus infer that it is fundamental that PSTs are familiar with the content knowledge of the mathematics they will teach in a way that they are able to disseminate it to the learners. An effective teacher in this study is therefore considered one who embraces both knowledge of the mathematics subject content and the ability to teach it.

6. CONCLUSION AND RECOMMENDATIONS

In conclusion, the findings clearly spell out that unless PSTs develop the ability to teach for understanding, develop pedagogical skills for teaching mathematics effectively, the ability to solve mathematical problems in the classroom and the skill to relate and teach learners of diverse abilities, then "learning to teach" would have failed to develop appropriate knowledge for teaching mathematics.

Considering the findings and implications on PSTs' mathematics content knowledge and mathematics teaching, the study recommends that the college syllabi be reviewed to include the core mathematics that PSTs are going to teach at 'O' level. This needs to be executed so that there is direct link between the colleges' syllabi with the school syllabus. Furthermore, effective mathematics teaching during practice (TP) needs to be approached in a holistic manner. This means knowledge for teaching mathematics during field placements requires PSTs to embrace PCK, CK and curriculum knowledge as one body of knowledge that develops the skill of mathematics teaching in the PST. The study recommends that training institutions provide some pedagogical support to the mathematics PSTs to address the structure and logic of teaching mathematics, which examines the relations and organisational forms of teaching in accordance with the goals of the nation, the college and the school curriculum.

7. REFERENCES

Adler, J. (2005). Mathematics for teaching: What is it and why is it important that we talk about it? *Pythagoras*, 62, 2-11. DOI: 10.4102/pythagoras.v0i62.109.

American Mathematical Society. (2012). *The mathematical education of teachers II. Conference board of the mathematical sciences (CBMS).* Issues in mathematics education. Washington DC: Library of congress cataloguing-in-publication.

An, S., Kulm, G., & Wu, Z. (2004). The pedagogical content knowledge of middle school, mathematics teachers in China and the U.S. *Journal of Mathematics Teacher Education,* 7(2), 145-172.

Ball, D.L., Hill, H.C., & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *Journal of the American Federation of Teachers,* 29(1), 14-47.

Ball, D.L., Thames, M.H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5), 389-407.

Borko, H., Peressini, D., Romagnano, L., Knuth, E., Willis-Yorker, C., Wooley, C., & Masarik, K. (2000). Teacher education does matter: A situative view of learning to teach secondary mathematics. *Educational Psychologist*, 35(3), 193-206.

Cochran, K.F., DeRuiter, J.A., & King, R. (1991). *Pedagogical content knowledge: A tentative model for teacher preparation.* Paper presented at the annual meeting of the American educational research association, Chicago.

Creswell, J.W. (2014). *Research design. Qualitative, quantitative and mixed methods approaches,* 4th edition. Thousand Oaks, CA: Sage Publication.

Cucu, M.C., & Lenta, O.E. (2014). Philosophical pragmatism in the digital era. *Postmodern Openings*, 5(1), 31-40.

Depaepe, F., Torbeyns, J., Vermeersch, N., Janssens, D., Janssen, R., Kelchtermans, G., Verschaffel, L., & Dooren, W.V. (2015). Teachers' content and pedagogical content knowledge on rational numbers: A comparison of prospective elementary and lower secondary school teachers. *Teaching and Teacher Education*, 47, 82-92.

Grouws, D.A., Howald, C.L., & Colangelon, N. (1996). *Students' conceptions of mathematics: A comparison of mathematically talented students and typical high school algebra students.* New York: American Educational Research Association.

Hine, G.S.C. (2015). Strengthening pre-service teachers' mathematical content knowledge. *Journal of University Teaching and Learning Practice*, 12(4), 1-13.

Hurrell, D.P. (2013). What teachers need to know to teach mathematics: An argument for a reconceptualised model. *Australian Journal of Teacher Education*, 38(11), 53-64.

Kessel, C. (2009). *Teaching teachers mathematics: Research, ideas, projects, evaluation*. Critical issues in mathematics education series, Berkeley, California: Mathematical research Institute (MSRI).

Kim, Y.R., Ham, S., & Paine, L.W. (2011). Knowledge expectations in mathematics teacher preparation programs in South Korea and the United States: Towards international dialogue. *Journal of Teacher Education*, 62(1), 48-61.

Kleickmann, T., Richter, D., Kunter, M., Elsner, J., Besser, M., Krauss, S., & Baumert, J. (2013). Pedagogical content knowledge and content knowledge of mathematics teachers: The role of structural differences in teacher education. *Journal of Teacher Education*, 64(1), 90-106.

Makamure, C. & Jita, L.C (2017). *Supervision Practices as Quality Assurance for Mathematics Pre-service Teachers in Zimbabwe.* Conference proceedings at the Institute of Science & Technology Education: University of South Africa. Pp 176-182.

Moore, J. (2005). Transformative mathematics pedagogy: From theory to practice, research and beyond. In A.J. Rodriguez & R.S. Kitchen (Eds.). *Preparing mathematics and science teachers for diverse classrooms*. Mahaw, New Jersey: Lawrence Erlbaum.

Organisation for Economic Cooperation and Development (OECD) (2009). *Education at a glance*. Paris, France: OECD Publications.

Richardson-Koehler, V. (2011). What happens to research on the way to practice? *Theory Into Practice*, 26(1), 38-43.

Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.

Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-21.

Steinbring, H. (1998). Elements of epistemological knowledge for mathematics teachers. *Journal of Mathematics and Teacher Education*, 1(2), 157-189.

Van Es, E.A., & Conroy, J. (2009). Using the performance assessment for California teachers to examine pre-service teachers' conceptions of teaching mathematics for understanding. *Issues in Teacher Education*, 18(1), 83-102.

Weimer, M. (2008). *Effective teaching strategies: The importance of marrying content and process.* Madison, USA: Magna publications.

Wu, H. (2014). Building better Mathematics Teachers. University of Califonia, Berkely. Retrieved from: https://math.berkely.edu [Accessed 20 August 2015].

Yong, T., Hua, M., & Feng-Mei, G. (2007). *Empirical study on impact of logistics operations capability on supply chain performance*. The third international conference on wireless communications, networking and mobile computing, Shanghai, China.

TEACHING MATHEMATICS USING VISUAL MODELS (GRADES 6 TO 9): THE CASE OF FRACTION IN SOUTH AFRICA AND NAMIBIA

Clemence Chikiwa

Rhodes University, South Africa

c.chikiwa@ru.ac.za

Abstract

This study underpinned by the constructivist theory, was to identify the nature of visual models used by teachers from Namibia and South Africa when teaching fractions, and how the identified visual models enhances conceptual understanding. Twenty-six grade 6 to 9 mathematics teachers Eastern Cape (EC) and thirty-four from Northern Cape (NC) in South Africa, and forty-four from Khomas Region in Namibia took part in this study. Data was collected through survey questionnaires, lesson observations and interviews. Results show that predominant use diagrams drawn on the chalkboard, compared to concrete objects, ICT and other visuals, was common amongst these teachers. The area model was predominantly used. Teachers agreed that the models were important for providing motivation, enhancing conceptual understanding and providing access to knowledge and meaning during teaching and learning. This study conclude that the teaching of fractions need to take advantage of visual models as teaching tools that can be used to help learners construct a better understanding of fractions. Teachers are encouraged to explore other models other than the area model when teaching fractions to grade 6 to 9 learners.

Keywords: Fractions, Visual models, conceptual understanding

INTRODUCTION

Fractions are a compulsory key component of the mathematics school curriculum in Namibia, South Africa and other countries. Research on the teaching of fractions is extensive in South Africa, Namibia and other parts of the world yet learners still struggle to understand fraction concepts (Bruce, Chang & Flynn, 2012; Department of Basic Education, DBE, 2015; Katenda, 2017; Siegler & Forgues, 2014). The mathematics education research literature is resounding in its findings that understanding common fractions is a challenging area of mathematics for learners to grasp (Bruce, Chang & Flynn, 2012; DBE, 2015; Tobias, 2014). Jerome Bruner developed a theory about the use of physical models or manipulatives when teaching mathematics and argued that learners would learn mathematics better if they first

encountered concepts and procedures by actively modelling them with manipulatives (Taber, 2009). Ability to work and calculate with fractions was noted as still a problem for intermediate and senior phase learners (DBE, 2015; Gabriel et al., 2013) and persist into high school and beyond (Schumacher & Malone, 2017). In normal circumstances grades 8 and 9 learners should revise common fractions and then focus on solving problems in contexts involving common fractions, mixed numbers and percentages (Department of Basic Education, DBE, 2011; Namibia, Ministry of Education, 2012). Basic addition and subtraction, multiplication and division are expected to be covered in earlier grades as stipulated by the curricula of Namibia and South Africa.

Learners of mathematics in schools seem to have difficulty retaining fraction concepts (Pantiziara & Philippou, 2012). "Fractions have been known from ancient civilizations until Current times, but they still pose major problems when learning mathematics" (Gabriel et al, 2013, p. 1). Learners' ability to understand and work with fractions is crucial. Teaching of fractions thus should be done in a way that helps learners to retain fundamental fraction concepts for current and later use. Nevertheless, most learners enter senior phase with inadequate preparation and prior knowledge necessary to succeed in this topic (DBE, 2015). Teachers' understanding of learners' difficulties in learning fractions seems crucial as that can lead to other mathematically related challenges such as mathematics anxiety, cumulative effect of failure, and can affect opportunities for further engagement in mathematics and science (DBE, 2018; Gabriel et al, 2013). It is against this background that I chose to explore the teaching of common fractions using visual models.

Incorporation of visualisation strategies, models and processes of teaching fractions is one way teachers may use to enhance conceptual and procedural understanding. A comprehensive definition by Arcavi (2003) presents visualisations as

> … the ability, the process and the product of creation, interpretation, use of and reflection upon pictures, images, diagrams, in our minds, on paper or with technological tools, with the purpose of depicting and communicating information, thinking about and developing previously unknown ideas and advancing understandings. (p. 217).

As alluded by Arcavi (2003) when visual aids, in their various forms, are created and used to communicate and foster thinking about fraction ideas in an endeavour to advance understanding in this area, then learning is enriched. This study focused on the teachers use

of visual models in form of pictures, images and diagrams on paper to develop conceptual and procedural understanding during teaching and learning of fractions in rural and township schools of Namibia and South Africa.

The aim of this study was thus to identify the nature of visual models used by teachers from Namibia and South Africa when teaching fractions, and how the identified visual models enhances conceptual understanding. The study was thus guided by the following questions:

> What is the nature of the different visual models used by senior phase mathematics teachers in selected regions of South Africa and Namibia in the teaching of common fractions?

> How can visual models be used to enhance conceptual teaching of fractions in mathematics?

TEACHING FRACTIONS USING VISUAL STRATEGIES

According to Henning (2013) and, Clarke, Roche and Mitchell (2008), some teachers find fractions difficult to teach, and in turn, learners find them difficult to learn. According to Clarke et al., (2008) much of the confusion in teaching and learning fractions appears to arise from the many different interpretations (constructs) representations (models), and coding conventions presented to them in earlier grades, for example, $\frac{5}{4}$, $1\frac{1}{4}$, 1.25 and 125%. There are, thus, many misconceptions in both the teaching and learning of fractions. Teachers in some cases struggle to find better strategies and appropriate visual aids to teach fractions so that learners understand the concepts and procedures needed to be able to work with the topic.

Visual models play an important role when students are learning about fractions (Cramer, Wyberg & Leavitt, 2008). Fraction circle models have been found to be one of the most powerful iconic representations for teaching fractions. Visual representations such fraction circles help to show the learners how the fractions are becoming smaller as the denominator becomes bigger. Pitsolantis and Osana (2013) posit that use of visual manipulatives helps learners to see the numerators and denominators of each fraction not as separate numbers. Atagi, DeWolf, Stigler and Johnson (2016) noted that despite the seeming usefulness of

visual representations in the teaching of fractions in lower grades, teachers rarely go back to these visual representations at later stages of learning, assuming that such representations have outlived their usefulness. The assumption in some cases is that once learners have been taught the symbolic notation of fractions then the visual forms are no longer necessary. Research outside Africa has established that visual representations shapes how learners conceptualise fractions, enable learners to make connections between their own experiences and mathematical concepts, and permits them to gain insight into abstract mathematical idea (Atagi et al., 2016; Pitsolantis & Osana, 2013; Rau & Matthews, 2017). My study thus looked at visual models in two African countries.

STRATEGIES FOR TEACHING FRACTIONS

The continual seeking of ways of teaching fractions for conceptual and procedural understanding cannot be overemphasised. Pitsolantis and Osana's (2013) study showed that teachers should not only include pictures and models while teaching fractions, but should also have them side by side throughout the class while continually making clear connections between the concepts and the models. In some cases teachers focus on giving learners procedures only during teaching which result in learners not understanding fractions.

To enhance understanding at whatever level of school learning, research has shown that it is crucial to represent mathematical ideas in multiple ways, including real contexts, physical models (manipulatives), pictures, verbalisations (Way, 2011) during the teaching of fractions. Taber (2009) said learners might explore equivalence in fractions by combining pieces of fraction circles. It is important for teachers to use different strategies that help learners to understand fraction concepts.

VISUAL MODELS

Visual models according to Konyalioglu, Asku, and Senel (2012), are tools which are used to represent abstract concepts of mathematics in a constructive way which leads to the mental interpretation of an image in the mind of learners. The "National Council of Teachers of Mathematics" (NCTM. 1989) indicate that visual models often make use of physical materials and other representations that help children develop understanding of fraction concepts. Visual models in mathematics' problem solving enhances comprehension and helps learners to come up with a variety of possible solution opportunities (Konyalioglu et al.,

2012*). Three common models used in teaching fractions are **area models** (for example, fraction circles, paper folding, geoboards), **linear models** (for example, fraction strips, number lines), and **discrete models** (for example, counters, sets).

Area is a good place to begin fraction explorations because it lends itself to equal sharing and partitioning. Circular fraction pieces are the most commonly used area models. One advantage of the area model is that it emphasizes the part whole concept of fractions and the meaning of the relative size of a part to the whole (Cramer, Wyberg & Leavitt, 2008).

The number line model, is based on the fraction's distance from zero and allows for the numerical value of the fraction to be located relative to the unit of 1. In this model, lengths or measurements are compared instead of areas. Research on fractions (Petit et al., 2010; Siegler et al., 2010) shows that the number line helps learners understand a fraction as a number (rather than one number over another number) and helps develop other fraction concepts.

In the set models, the whole is understood to be a set of objects, and subsets of the whole make up the fractional parts. For example, 3 objects are one fourth of a set of 12 objects. The set of 12 in this example represents the unit, the whole or 1.

Research conducted by Fazio and Siegler (2011) revealed that visual models of fractions help develop conceptual understanding of computational procedures. Learners are often taught computational procedures without adequate explanation of why the procedures work. Yet, research has shown a positive correlation between learners' conceptual understanding of fractions and their success in using procedures to solve problems. Thus, teachers should focus on developing learner's conceptual understanding of mathematics concepts. One way to improve conceptual understanding, which is the focus of my study, is to use visual models when teaching fractions.

THEORETICAL FRAMEWORK

This study is framed and guided by constructivist theory from both the cognitive and sociocultural perspectives. Constructivism is a theory that assumes knowledge is not passively received but built up by the cognizing subject (Glasersfeld, 2005). In the realm of constructivism, knowledge is constructed through active learning and participation. In a constructivist learning environment, teaching is learner-centred and the teacher's role is

to act as a facilitator. Constructivism encourages teachers to be flexible in their approaches and to use different strategies to allow learners to choose one method they understand best (Tobin, 1990). This is because for a constructivist, knowledge is constructed from the meanings one attributes to the environment in which he or she exists (Glasersfeld, 2005). Learning takes place by doing, and, errors and misconceptions are important for learning to take place. Constructivism proposes that learning environments should support multiple perspectives or interpretations of reality (Tobin, 1990), knowledge construction, context-rich and experience-based activities. In the constructivist's world, knowledge is a reflection of a representation, a portrait, or an objective world.

Constructivism focuses on knowledge construction not knowledge reproduction. Teachers who have adopted these theories believe that children construct their own mathematical knowledge, rather than receiving it in finished form from the teacher or the textbook (Carpenter, 2003). An important component of constructivist theory is focusing child's education on authentic tasks. Learning should integrate those tasks that are of the real world relevance and utility across the curriculum and provide appropriate levels of difficulty or involvement. Vygotsky (1986) posits that there is no knowledge independent of the meaning attributed to experience (constructed) by the learner, or community of learners. Hoong, Kin and Cheng (2015) suggested that if a child is to deal with mathematical properties he will have to deal with symbols or else he will be limited to the narrow and rather trivial range of symbolism that can be given directly. Thus visual models used in this study were not meant to be an end in themselves but mediate and scafold teaching so as to use fraction symbols and generilisations with understanding. This also helped to avoiding limiting learners' reasoning capability to the taught knowledge but help the learner to construct knowledge and deal with many mathematical problems and situations. In this study I viewed teaching mathematics as a cognitive activity constrained by social and cultural process, and also as a social and cultural phenomenon constituted actively cognizing learners (Wood, Cobb & Yackel, 1995).

METHODOLOGY

In this case study, purposive convenient sampling was used to identify my research participants. The first case comprised of mathematics teachers from Eastern Cape (EC) (26 teachers) and Northern Cape (NC) (34 teachers) in South Africa, who are studying for their

Bachelor of Education degree (in-service) at a university in Eastern Cape. The second case were 44 mathematics teachers from Khomas Region in Namibia. All participants from the two countries were teaching grades 6 to 9. Data was collected through survey questionnaires, lesson observations and stimulus recall interviews.

Four teachers purposively selected from each province/region basing on their willingness, availability and convenience were observed teaching three lessons each and were interviewed after teaching the three lessons. During lessons observations, interest was on the visual models teachers used. Stimulus recall interviews were based on what transpired during the observed lessons. Data was analysed in two stages. First, quantitatively looking at how many teachers said they used certain visual models and strategies. The number of teachers corresponding to each type of model were converted to percentage. Secondly, qualitatively according to questions asked in the survey and interviews, and emerging themes that were influenced by both cognitive and sociocultural constructivists' ideas.

VALIDITY

Validity was ensured by using multiple sources of evidence, which are survey questionnaire, lesson observations and stimulus recall interviews.

FINDINGS

Visual models used by teachers

In this survey, 88% of the teachers in Khomas Region, Namibia and 100% from South Africa (EC & NC) (see Figure 1) reported that they used some form of visual models when teaching fractions. This could be because all the SA teachers were students at a university in the Eastern Cape province. They were on a 3-year part-time in-service B Ed degree programme. According to one of the SA teachers, *"this programme encourages creativity and use of visuals in the classroom during teaching"*. Only 12% from the Namibian group said they use none (see Figure 1).

In these regions, survey data revealed that 22% (Namibia) and 20% (SA) used diagrams to teach fractions. The South African group used concrete objects much more often than their Namibian counterparts (22% SA & 19% Namibia). The other visual strategies were used less by Namibian teachers. This was because they said diagrams could be drawn quickly on the chalkboard or white board or on paper thereby requiring relatively little time to prepare than

the other visual models. ICT, which is expected to be gaining more use in this modern era, was used by only 2% (see Figure 1) of the grade 8 teachers in the Khomas Region.
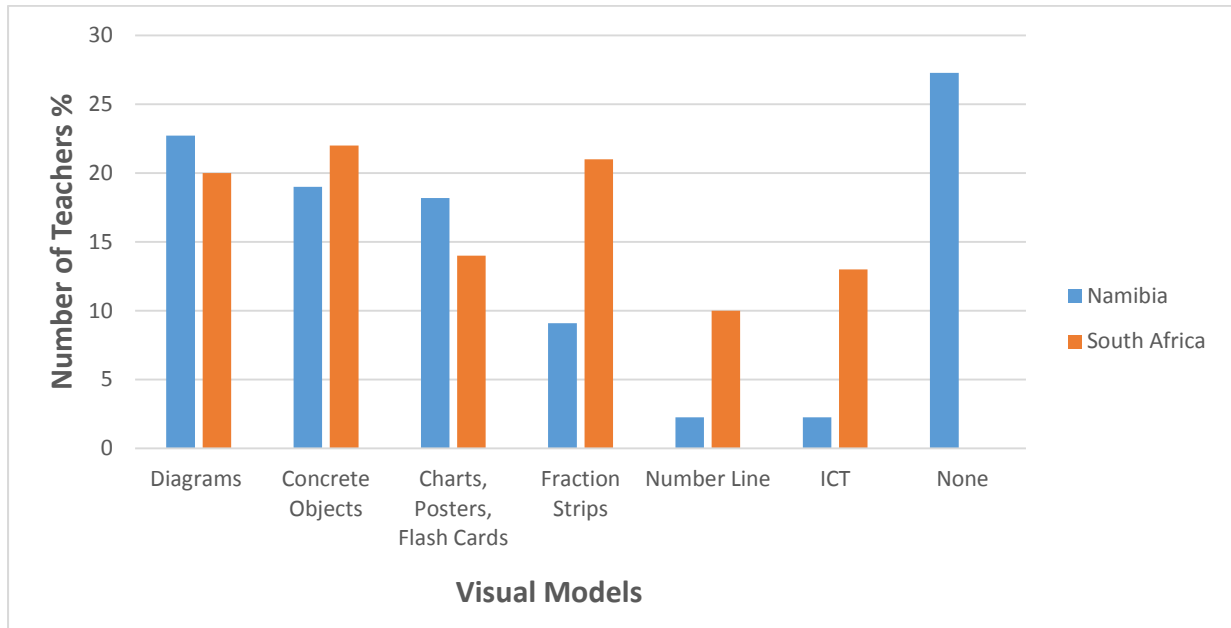

Figure 1: Types of visual models used by teachers in Namibia and South Africa

Teachers from SA were on an in-service programme that is inclusive of computer use in teaching and learning of mathematics. This thus can be attributed to the 13% of teachers who reported that they use ICT related visuals to teach mathematics. Only 2% of the Namibian teachers indicted that they were using ICT.

During interviews, teachers were asked why they used visual models. They alluded to the importance and classroom benefits of using visual models.

Presentation with visual models helps learners see exactly how the fraction is represented. In mixed numbers, they see everything that you have a whole and they can clearly see that this is a full whole of a fractions and this is the part of a fraction. So I think it helps learners to visualise and see exactly what is happenings in class in comparison to those old models **(Mr Malele)**

Learners find it easy and even enjoyable to use visual models, because these learners like seeing instead of just hearing number, they are used to numbers already and some of them are scared of numbers. When they use visual models, mathematics becomes something more interesting than when we use numbers only, that's what I observed. **(Mr Mose)**

Mr. Malele pointed out that a visual model concretises learning of fractions by bringing reality in the classroom. Mr. Mose added that visual models makes learning much easier and enjoyable for learners. While the study asked about various models that teachers used, most teachers when observed were using very few of those models that were identified. In the survey and interviews, some teachers said they only use one. In the survey, one teacher from Namibia wrote, *"I mostly use diagrams to illustrate what fractional parts are"* Another one said, *"I use paper strips and drawings to show the numerator and the denominator"* Very few of these teachers were using a variety of these models when teaching common fractions.

Teaching of fractions

In the survey, teachers indicated that they used different materials to teach fraction and they used them in different ways to make learners understand the concept of fraction better. In the survey, teachers were asked about what manipulatives they use to teach fractions, and some of them said

- *I use videos on fractions in my teaching. (SA Teacher)*
- *I use mostly paper strips and drawings to show the numerator and the denominator. (SA Teacher)*
- *I use different manipulatives such as drawings, strips and cut different objects to form up a fraction. (Namibian Teacher)*
- *I make use of computer programmes to show fraction concepts. (SA Teacher)*
- *I normally draw fractions in cards, cut fruits into different fractions, using readymade materials that shows fractions. (Namibian Teacher)*
- *I use geometric shapes to introduce fractional numbers, by cutting the shapes out or paper plates. (SA Teacher)*

Teachers from both countries indicated that they use paper strips, drawings and other geometric shapes (as indicated in Figure 1). SA teachers however reiterated how they used ICT in teaching fractions. The Namibian teachers rarely used ICT as shown above. Nevertheless, during teaching, the teachers we observed were all using the area model. When interviewed, Mr Malele and Ms Nalo explained why they favoured this model:

The two model that I have used, area and number line, are both helpful. But I have seen that using area models is quite easier, where you just draw separate whole and you divide them into parts as given by the fractions that makes learners to understand it much better compared to the number line model. The area models is easy to use because it connects with other previously done concepts. But in my own capacity as a teacher, the area model is a bit easier because one, it's easier to draw and it's also easier to present. **(Mr Malele)**

The area model is easy and convenient to use. The area model was the best one, compared to the number line. The problem with the number line is when it comes to finding the lowest common multiple of the denominators. **(Ms Nalo)**

With the area model cutting the whole drawing into small pieces so they can see from the drawing where the common denominator comes from by counting. So, when you cut in those twelve equal parts of a different colour inside that area model learners can see those parts that you draw in compared to the number line where you have to put the small lines on top. The area model is the best and it is user friendly. The number line is bit complicated. **(Mr Mose)**

The dominance of the area model in the observed classes was due to this model being easier to draw and use, and the ability to link area model to prior knowledge. Ms Nalo argued that the number line model was not as easy to use as the area model when adding or subtracting fractions of different denominators. All these factors lead to the dominant use of the area model we observed in this study.

Teachers during the survey alluded to the relevance of using visuals models drawn from the local environment. Some of their statements are given below:

- *Teachers need to give practical example of sharing whole unit and emphasise on parts as fraction of the whole.* **(SA Teacher)**
- *One can use an orange that is pilled and divided to make learners understand better the concept of fraction.* **(SA Teacher)**
- *Illustrate by incorporating examples such as pizza or pictures of a sliced pizza.* **(Namibian Teacher)**
- *By make use of materials like apples, pie cut them in slices and using number of learners in the class.* **(Namibian Teacher)**

The use of everyday and locally found visual materials was noted by most teachers from the two countries. These teachers considered the chosen examples such as pizza, apples and oranges as useful. A few of the teachers suggested role modelling. One participant said, "*Use learners themselves, arrange them in groups then ask one learners to stand and make a fraction of the whole group.* While using learners in the class is plausible, one must guard against disadvantaging those who are role-playing. In addition, mathematization should be prioritised at all stages of learning.

Significance of using visual models when teaching fractions

Participating teachers indicated the importance of teaching fractions using visual models at senior phase. Mr Maka said "*Use of visuals is common at primary school level but we can continue with using them up to senior school level because learners are struggling with fractions at these senior levels. How to use visuals should be included in books and study guides on how to teach fractions.*" Mr Maka added that senior phase mathematics textbooks and study guides should address the use of visuals as well. Some of their response from other teachers during the survey were;

- *Visuals helps learners in grade 8 and 9 to understand the concept much better and links very well with intermediate phase.* **(SA Teacher)**
- *In my junior secondary class, visuals enables learners to attach meaning to the concept being taught and to link with daily live.* **(Namibian Teacher)**
- *It helps learners to understand the concept of fraction much better and it help them to understand the concept of fair sharing.* **(Namibian Teacher)**
- *Learners in the senior phase still struggle with basic mathematics concepts hence the use of models is crucial.* **(SA Teacher)**

Teachers in this study viewed the use of models as providing access to knowledge, understanding and meaning during the learning process. Teachers also mentioned that visual models are significant for bridging the gap between, theory and the concrete of fractions, as well as between phases of learning for SA learners. In the survey, they also mention that visuals aid memory and retention of learnt materials about fractions.

- *Learners remember better when they see as opposed to when they just hear it.* **(Namibian Teacher)**
- *It help the learners to see the reality of fraction, make comparisons or links.* **(Namibian Teacher)**
- *Perception in children develop broadly when human senses are intensively involved and fraction concepts are a bit abstract because they represent quantities that are not whole. Therefore, visualisation is important in the sense that it help learners to develop broadly mathematics concept especially common fraction and help learners to relate to other concepts.* **(SA Teacher)**
- *It help learners to grasp the concept easily and they hardly forget it because they will have the picture in mind.* **(SA Teacher)**

Various teachers' experiences drawn from interviews are highlighted below as an example of how these teachers experienced the significance and challenges of these models in their teaching. Teachers in this study agreed that visuals were a good enhancer of conceptual understanding. They also indicated that use of visuals made their teaching easier and interesting. Mrs Sonke highlighted the difficulties with the 'traditional' ways of teaching fractions as compared to the visual way.

I gained more experience using models during this period and process. I wish maybe it could be even part of the prescribed books we using in teaching. If it's part of textbooks learners use, it will serve time that we spend in drawing. I also learnt that using visuals is easy and it helps learners to understand this topic much better. **(Ms Qaku)**

Using visuals allows learners to be involved in their own learning. The old ways of teaching are a bit difficult especially when dealing with ordering and comparing fractions. The use of visuals is very easy for our learners and it helps them understand this topic of common fractions in no time. **(Mrs Sonke)**

It makes learners to understand and the lesson be interesting. There are some challenges though because now for the area model I tried to draw the models before they come to class but when they find them already drawn on the chalk board they do not concentrate much on where you are explaining, they will start to run through all the drawings and trying to find the answers even of the one that are not yet explained. So I draw while they are there but then it is time consuming. Sometimes you struggle with the colours chalks, maybe you draw with a white one, you colour with green and then you want to find the lowest common multiple. So here time, technology and resources are the main challenges. (Mr Mose)

All teachers interviewed highlighted the issues of time. Others also mentioned the amount of preparation and thinking that is required. Nevertheless, they all agreed that this is a worthwhile endeavour as it fosters understanding of mathematical concepts as compare to the traditional methods. Ms Qaku also suggested that the inclusion of visual models in learners' textbooks would assist both teachers and learners during the teaching and learning of fractions.

The negative difference is that teaching with visuals is a bit slow because of the drawing and colouring. The time that we spend in a lesson is much longer compared to the theoretical way of teaching, where we just say two over five then we go to three over four without drawing them (Mr Sonke).

When I used visuals I observed we were a bit slow but learners were interested in the lesson, they wanted to ask and draw. Thus even if the method is slow, it good. (Ms Tate)

We were slow but we are getting the objectives usually without visuals we use to be fast but they do not understand. The visual method is very easy to use and for learners to get the answers and it does not involve calculator that is the difference that I have observed between these two methods (Mr Mose)

Teachers in the interview pointed out that the use of visual models helped them in during teaching in terms of increasing participation, interest and understanding. These same teachers were quick to point out that the visual methods were time consuming and required more effort. To these teachers, using visual models made teaching much easier for learners and enhanced understanding of fraction concepts when he compared it with 'traditional' methods.

SUMMARY AND CONCLUSION

Mathematics teachers who took part in the survey were noted to predominantly use diagrams drawn on the chalkboard, as compared to concrete objects, ICT and other visuals. Teachers highlighted many benefits of using visual models when teaching fractions. Lesson observations revealed that teachers preferred the area model. This resonates with the prevalent use of diagrams mentioned above. They pointed out that the area model was easier and more convenient to use as it also linked with learners' prior knowledge and integrated fractions with other domains of mathematics.

Challenges noted related to the time required to prepare the visual materials and time consumed when using them. They suggested that visuals be incorporated in the learners' books. While teachers agreed that visual models were instrumental in bridging the gap between the concrete and the abstract, these same teachers were not using locally available concrete materials as frequently as would be expected. Teachers agreed that the models were important for providing motivation, sustaining interest, enhancing conceptual understanding and providing access to knowledge and meaning during teaching and learning.

This study concludes that the teaching of fractions need to take advantage of visual models as mediational tools that can be used to help learners construct a better and long lasting conceptual understanding of fractions. While the study acknowledges that certain visual models work best and well with certain mathematical concepts, it encourages teachers to explore further other models other than the area model when teaching fractions to senior phase learners.

REFERENCES

Arcavi, A. (2003). The role of visual representations in the learning of mathematics. *Educational Studies in Mathematics, 52*(2), 215-241.

Atagi, N., DeWolf, M., Stigler, J. W., & Johnson, S. P. (2016). The role of visual representations in college students' understanding of mathematical notation. *Journal of Experimental Psychology: Applied, 22*(3), 295-304. doi:doi:10.1037/xap0000090

Bradford, W. C. (2011). Reaching the Visual Learner: Teaching Property Through Art. *The Law Teacher*. Retrieved from https://ssrn.com/abstract=587201

Bruce, D., Chang, D., & Flynn, T. (2012). *Foundations to learning and teaching Fractions: Addition and Subtractions.* Ontario, Canada: Trent University, Ontario Ministry of Education.

Carpenter, S. (2003). Constructivism: A prospective teacher's perspective. *Australian Primary Mathematics Classroom, 8*(1), 29-32.

Clarke, D. M., Roche, A., & Mitchell, A. (2008). 10 Practical tips for making fractions come alive and make sense. *Mathematics Teaching in the Middle School, 13*(7), 373–379.

Cramer, K., Wyberg, T., & Leavitt, S. (2008). The role of representations in fractionaddition and subtraction. *Mathematics Teaching in the Middle School, 13*(8), 490-496.

Creswell, J. W. (2015). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research (5th ed.).* Boston, MA: Pearson.

Department of Basic Education, DBE. (2011). Curriculum and Assessment Policy Statement, CAPS, Grade 10-12. Mathematics.

Gabriel, F., Coche, F., Szucs, D., Carette, V., Rey, B., & Content, A. (2013). A componential view of children's difficulties in learning fractions. *Frontiers in Psychology: Developmental Psychology*, 1-12.

Glasersfeld, E. (2005). Introduction: Aspects of constructivism. In C. T. Fosnot (Ed.), *Constructivism: Theory, Perspectives and Practice (2 nd. ed).* New York: New York Teachers College, Columbia University.

Gupta, S. (2011). Constructivism as a paradigm for teaching and learning. *International Journal of Physical and Social Sciences, 1*(1), 23-47.

Haufiku, A. (2006, July). *Upper Primary Mathematics: Facilitators' Training Workshop. Report on activities carried out during the trainings of the facilitators of Mathematics at the Upper Primary phase.* Okahandja-NIED, Windhoek: NIED.

Henning, E. (2013). Solving the problem of maths. *Mail & Guardian, 18 January 2013*.

Hiebert, J., & Lefevre, P. (1986). Conceptual and Procedural Knowledge in Mathematics: An Introductory Analysis. In J. Hieber (Ed.), *Conceptual and Procedural Knowledge: The Case of Mathematics* (pp. 1-27). Hillsdale, NJ: Erlbaum.

Hoong, L. Y., Kin, H. W., & Pien, C. L. (2015). Concrete-Pictorial-Abstract: Surveying its origins and charting its future. *The Mathematics Educator, 16*(1), 1-19.

Horn, R. E. (2001). Visual Language and Visual Language and Converging Technologies in the. *A paper prepared for the National Science Foundation Conference on Converging Technologies (Nano-Bio-Info-Cogno) for Improving Human Performance Dec. 3-4, 2001.* Stanford University.

Katenda, A. (2017). *Teaching Fractions Using Models.* Windhoek: Longman.

Khan, S., & Van Wynsberghe, R. (2008). Cultivating the under-mined: Cross-case analysis as knowledge mobilisation. *Forum: Qualitative Social Research, 9*(1), 34. Retrieved from www.qualitative-research.net/index.php/fqs/article/viewArticle334/729

Khashan, K. H. (2014). Conceptual and procedural knowledge of rational numbers for Riyadh Elementary School teachers. *Journal of Education and Human Development, 4*(3), 181-197.

Konyalioglu, A. C., Asku, Z., & O, S. E. (2012). *International Journal of Mathematical Education in Science and Technology, 43*(5), 613-626.

Konyalioglu, A. C., Isik, A., Kaplan, A., Hizarci, S., & Durkaya, M. (2011). Visualization approach in teaching process of linear algebra. *Procedia-Social and Behavioral Sciences, 15*, 4040-4044.

Mayer, R. E. (2001). *Multimedia Learning.* Cambridge: Cambridge University Press.

Namibia. Ministry of Education. (2010). *The National Curriculum for Basic Education.* Windhoek: NIED, Ministry of Education.

National Council of Teachers of Mathematics (NCTM). (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: National Council of Teachers of Mathematics.

National Council of Teachers of Mathematics, NCTM. (2010). Using two languages when learning mathematics. How can research help us understand mathematics learners who use two languages? *National Council of teachers of Mathematics, 2010.*

NEEDU. (2012). *National Report 2012: Summary.* Department of Basic Education. Pretoria, South Africa: National Education Evaluation and Development Unit (NEEDU). Retrieved from http://www.saqa.org.za/docs/papers/2013/needu.pdf

Pantziara, M., & Philippou, G. (2012). Levels of students'"conception" of fractions. *Educational Studies in Mathematics, 79*(1), 61-83.

Postolantis, N., & Osana, H. P. (2013). Linking concepts and procedures. *Teaching Children Mathematics, 20*(1), 18-25.

Ramani, G. B., Siegler, R. S., & Hitti, A. (2012). Taking It to the classroom: Number board games as a small group learning activity. *Journal of Educational Psychology, 104*(3), 661-672.

Rau, M. A., & Matthews, P. G. (2017). How to make 'more' better? Principles for effective use of multiple representations to enhance students' learning about fractions. *ZDM - Mathematics Education, 49*(4), 491-496.

Schumacher, R. F., & Malone, A. S. (2017). Error patterns with Common fraction calculations at fourth grade as a function of students' mathematics achievement status. *Elementary School Journal, 118*(1), 105-127.

Siebert, D., & Gaskin, N. (2006). Creating, naming and justifying fractions. *Teaching Children Mathematics, 12*(8), 394-400.

Siegler, R. S., & Forgues, H. L. (2014). Conceptual knowledge of fractions arithmetic. *Journal of Educational Psychology, 3*(107), 909-918.

Taber, S. T. (2009). Capitalising on the unexpected. *Mathematics Teaching in the Middle School, 15*(3), 149-155.

Tobias, M. J. (2014). Strategies to compare fractions. *Mathematics Teaching in the Middle School, 19*(6), 376-381.

Tobin, K. (1990). Social constructivist learning model. *The Science Teacher, 67*(1), 29-35.

Tsankova, J. K., & Pjanic, K. (2010). The area model of multiplication of fractions. *Mathematics Teaching in the Middle School, 15*(5), 281-285.

Vygotsky, L. S. (1986). *Thought and Language.* (A. Kozulin, Ed.) London, England: The MIT Press.

Way, J. (2011). Developing Fraction Sense Using Digital Learning Objects. In AAMT, *Fractions: Teaching for Understanding* (pp. 153–166). Adelaide: The Australian Association of Mathematics Teachers (AAMT) Inc.

Wood, T., Cobb, P., & Yackel, E. (1995). Reflections on learning and teaching mathematics in elementary school. In L. Steffe, & J. Gale (Eds.), *Constructivism in Education* (pp. 401- 422). Hillsdale, NJ: Lawrence Erlbaum.

CREATING AN ENVIRONMENT FOR THE RESTORATION OF MATHEMATICS INTEREST TO DISADVANTAGED FOUNDATION CLASSROOMS

Zingiswa Jojo
University of South Africa
jojozmm@unisa.ac.za

Abstract

In South Africa, it was only after the end of the apartheid era that ended in 1994 that the education became a vehicle for transforming society and a political rhetoric of equity and quality education was prioritized. The significant learning is distorted in the disadvantaged mathematics classrooms due to absence of qualified facilitators. Learners are unable to construct mathematics concepts in that kind of environment. This paper chronicles how that environment can be disrupted in order to restore interest to disadvantaged mathematics foundation classrooms. The article reports on how the variation theory was used to provide the sequential building blocks required to learn foundation mathematics to grade 1- 5 learners in a district in the Eastern Cape province of South Africa. A sample of 23 learners participated in this study. This was a qualitative study in which structured worksheets covering mathematics content for grade 1-5 were prepared for the learners to practice after school in a homework club on their own, in rural settings. Results indicated how the creation of a supportive and caring environment developed the learners' resilience, restored their interest and increased their competence in understanding of basic mathematics concepts. The learners also developed good relationships with each other while they shared information and helped others to understand mathematics concepts and led them ultimately to independence of acquiring other mathematical skills and ownership of the learning experiences. The intervention with the after school programme may serve to break the cycle of poverty for the disadvantaged learners and restore their competence in understanding mathematics concepts while providing a platform for learners to share knowledge gained with the underprivileged ones.

Keywords: Disruption, Environment, Interest, Instructions, Learning, Mathematics concepts, Poverty

Introduction

When a child misses one step in a mathematics lesson, it becomes impossible for him/her to understand what comes next in other lessons. Mighton (2015) asserts that learners who do well in mathematics are much more likely to finish school, attend university and earn good living than learners who struggle in the subject. On the contrary, Spaul (2013) asserts that while mathematics is a strong predictor of academic success, children who attend dysfunctional schools without qualified mathematics teachers incur achievement gaps that impose the equivalence of a permanent national recession on a country's economy.

According to Jeanty (2008), sociological studies show the effects of poverty as being passed down from generation to generation. Consequently, stressful conditions within the home environment tend to be prone towards ineffective communication patterns, which serve to further hamper the child's ability to communicate within the classroom. In South Africa, Timaeus, Simelane, & Letsoalo, (2011) note that although great progress has been made in enrolling children into school at the appropriate age, there remains differentials in school grade progression by race and geographical areas. This disparity therefore suggest that South African school policy must develop complementary strategies to change the poverty landscape of the country. Timaeus, Simelane, & Letsoalo, (2011) further note failure by the government to ensure consistent acceptable standards in rural schools with respect to lack of basic facilities and poor teacher training resulting in ineffective teaching techniques to perform high quality work in trying conditions. Consequently, poverty continues to hold back children's progress at school in South Africa and in particular, the inter-related effects of socioeconomic status, race and environment are escalating.

Spaull (2013) avers that children in most Eastern Cape schools in South Africa fall further and further behind the curriculum leading to a situation where remediation is almost impossible in high school since those learning gaps have been left unaddressed for too long. Gaps in mathematics grounding of basic concepts leave children wanting and deprived of understanding this subject as they move to higher levels of instruction. Since this subject is a pre-requisite to enroll for prominent careers like medicine, architecture, engineering, economics and other fields, the implication is that very few learners from underprivileged schools remain mathematically competent enough to access those careers (DoBE, 2011).

The construction of mental representations of direct experiences relevant to a particular concept in mathematics, is essential for learners to obtain mathematical meaning. Constructivists, (Brownell (1935), Piaget (1972), Vygotsky (1987), Dienes (1966), & Bruner (1960)) assert that that children learn by building or constructing their own knowledge by integrating new concepts and procedures into existing mental structures. This study reports on a research conducted with children in impoverished community whose life possibilities are far from reaching the promises of globalized mathematics discourses and of social and economic democracy. It is an attempt to illustrate how the mathematics knowledge gap created in the classroom due to absence of trained qualified facilitators can be closed for restoration of mathematics interest to affected learners.

This article resumes by outlining and formulating the poverty cycle which learners find themselves in most rural schools and how their mathematics interest is challenged in the classrooms. The issue of how children in under developed schools are compromised on mathematics interest, self-respect and freedom to think critically is addressed. Then the theoretical notions of variation on which the researcher constructed the meaning of space when working with primary school children in lower grades is presented. Other related discursive fields were used for the intervention programme to help learners make meaning of space in their surrounding environments will also be presented.

Lebech (2009, p1) defines dignity as what is proper to the kind that 'one' is or to the species of rational humanity. In particular, it refers to that which in a personal being induces or ought to induce respect: its excellence or incomparability of value, the quality of being worthy of esteem or respect.' This author further notes that the building of character in a human being occurs when the integration of physicality and personal experience in a unity is accounted for in reason. The detachment where learners cannot identify with other learners and with their role in the immediate environment, disables them in synthesizing their abilities and knowing who they are as individuals. It is only when learners identify with what lies beneath or supports their nature and immediate environment, their reasoning ability and social integration, that they open up the depths of the person. The creation of meaningful learning experiences for learners allows both learners and teachers to experience the mathematics classroom as a place of engagement, deeper meaning, and discovery. In this engagement learners get to know that they are valued as people and that their teachers care about their

well-being and not just their grade, and this results in a shift of the classroom dynamics. In addition, some researchers note that learners need to know that using their imaginations in meaningful ways is critical to their education and, ultimately, their lives. Thus teachers need to emphasize relationships more than compliance and prioritize learners' voices in a mathematics classroom while they ensure that learners' concept abstraction is activated.

The legacy of poverty and neglect in most rural schools is far from being eliminated, partly because of the emphasis in South Africa is on urban development. Gardiner (2017) argues that the achievement of real quality in education in rural areas in South Africa can only come about when there is significant social and economic development in those areas. Much often, classrooms in the foundation phase are under the instruction of less informed or unqualified mathematics teachers. Until that problem is redressed, the education provided in under-developed areas will limit learners' opportunities to lead long, healthy and creative lives, or to acquire knowledge and enjoy freedom, dignity and self-respect. In this study, the main objective was to answer the research question, 'how can an environment for the restoration of mathematics interest to disadvantaged foundation classrooms be created?' Some ways in which the poverty of the mind can be rebuked while providing foundation phase learners with sound understanding of meaning in mathematics irrespective of prevailing conditions in their school environment are suggested.

Literature Review

Literature in this article is arranged according to incremental themes that emanated from the data coding and analysis. It first addresses the level of communication and creativity that integrates human society through the arousal of mathematical interest in children in the foundation phase. This also outlines how the other social ills are affected by the absence of due enablers of mathematics learning. The first one is human dignity. Next the article outlines how children in impoverished communities interact with mathematics presented to them. Lastly it emerged from data that children growing with stress of lack of teaching facilities cope with understanding the development of mathematics concepts.

Hawthorne (2011) avers that human dignity means that an individual or group feel self-respect and self-worth. It is concerned with physical and psychological integrity and empowerment of a person in totality. Human dignity is harmed by unfair treatment premised

upon personal traits or circumstances which do not relate to individual needs, capacities, or merits (Hawthorne, 2011). Such integration relies on access to ideal reality through abstraction, intuition and discursive reasoning; it relies on reason. The cycle of poverty in this article is conceptualized as set of factors or events by which learners in poor dysfunctional rural schools are disadvantaged such that they grow up and join higher grades with gaps in mathematics knowledge. This article challenges this hegemony and illustrates how out of school intervention can disrupt this trend.

Luby (2015) warns that children growing up in poverty can experience detrimental effects which may lead to long-lasting negative consequences on brain development, emotional health and academic achievement. Research has shown that growing up in poverty increases the likelihood that children will begin school well behind their more economically advantaged peers. Also, children from poor families often start school with inadequate social-emotional skills, which can stymie academic progress. In addition, O'Connor, Cappella, & McCormick, (2014) assert that learning is enhanced when it also addresses the social and emotional development of children. In particular, children's development of self-regulatory skills that are vital to learning, include sustained attention span and curbing inappropriate behaviors. Kim, Evans, Angstadt, Ho, Sripada, Swain, Liberzon & Phan (2013) also allude to the fact that the stress-burden of growing up poor may be an underlying mechanism that accounts for the relationship between poverty as a child and how well your brain works as an adult.

In addition, Kim, et. al (2013) assert that children living with stress from childhood related to substandard housing, crowding, noise, and social stressors like family turmoil, violence or family separation conditions, usually has an effect on the relationship between childhood poverty and prefrontal brain function during emotional regulation. It then becomes difficult for learners from such situations to cope with school work that requires them to interpret and understand building blocks for mathematical concepts. In geometry for example, children in the foundation phase must be able to identify and differentiate between shapes like squares, rectangles, circles, and triangles. Other geometric concepts like parallelism, congruency, similarity, and perpendicularity are then built from a variation and discernment of what is and what is not of the basic shapes. Moreover, teaching is about putting learners where they will want to learn and where they can naturally discover their true passions. In the standard

government oriented classrooms found in our schools, equipped with only chalkboard and chalk, learners' thinking is not stimulated. On the contrary Dewey (1933) notes that one cannot teach today the same way one did the previous days to prepare students for tomorrow. He pronounces that 'society with too few independent thinkers is vulnerable to control by disturbed and opportunistic leaders. A society which wants to create and maintain a free and democratic social system must create responsible independence of thought among its young. He further asserts that giving the learners something to do, not something to learn, and the doing is such a nature as to demand thinking, learning naturally results. It is therefore unfortunate that some of the learners who were participants in this study were deprived of an opportunity to learn in their first and second years of their formal tuition due to absence of qualified facilitators.

Theoretical Framework

Work with pre-schools in the US suggests early instruction in conceptual numeracy and language skills may somewhat improve the ability of those children to with the skills and knowledge taught in primary schools. These studies also indicate that unless extra-school compensatory education is practiced, the academic disadvantaged learners cannot cope with knowledge acquisition together with cognitive skills that need to be developed.

This study was conducted in a free after school environment where learners were required to sort shapes and then justify how they grouped them. When sorting of a variety of mixed shapes, learners must decide on how to group them being directed by their appearance. They then explain to each other why certain shapes belong together depending on the development of their visual skills. The study was conducted according to a specific framework making distinctions in mathematics education, which guided the systematic enquiry of how learners acquire mathematical knowledge and what instructional interventions contribute to the development of their learning. Theoretically, this article reports on a study underpinned by the variation theory. In this theory, Ling and Marton (2012) note that a person's ways of seeing or experiencing a particular object or material concept, is considered fundamental for his or her learning. In turn, Marton and Booth (1997) assert that how the object is seen or experienced is determined by what aspects of the object the learner discerns and how he or she relates the discerned aspects to each other simultaneously.

According to Marton (2012) learning is always directed at something. It may be certain aspects of reality, an object of learning, a skill or a phenomenon. He asserts that after learning about something or a skill, one then changes in the way he/she sees that object because of the things he/she has learnt about it. The aspects of the object one notices and focuses on form the basis of understanding that particular phenomenon. Variation theory sees learning as the ability to discern different features or aspects of what is being learned (Ling & Marton, 2011). Gu, Huang & Marton, (2004), argue that repetitive learning with certain variations could be meaningful. This has been misinterpreted in many mathematics classrooms where learners are made to recite and repeat after the teacher the definitions of some concepts in the foundation phase. For example, learners would have to repeat after the teacher that, 'a rectangle is a closed four sided figure with two pairs of opposite sides equal and parallel'. The number of times that the learners repeat this does not mean that they understand the object of learning. They also have to identify rectangular objects in their classroom environment and be able to discern some critical features that make that particular figure to be a rectangle.

Learners must then separate objects according to identified critical features from other objects that are seen not to have such characteristics. This is an essential skill when they sort geometric figures even before they classify them. It is then after the separation that they learn to generalize that all shapes with particular critical features belong to a certain group. The teacher must design the lessons in a sequential manner that guides the learners to discern what is and what is not. Leung (2003) asserts that discernment comes about when features of the concept are being focused and temporarily demarcated from all other features.

Much often when learners are given basic geometric shapes to sort in the foundation phase, they rarely group them according to the different shapes. They often group them according to observed difference in color. Although the variation theory has been used in the learning of mathematics in this study, it can be used in other subjects also. In this theory it important for the learners to understand the object of learning, and this can be identified in other content areas as well. This is in conjunction with the variation theory which describes three types of objects of learning (Marton and Booth 1997; Runesson 2005) in any instructor–learner relationship. (i) An intended object of learning which the mathematics teacher anticipates his/her learners to develop, (ii) an enacted object of learning which results from the

experiences that the interaction between learners and the teacher or between the learners and themselves affords, and (iii) a lived or actual object of learning experienced by learners in the interaction. Very often the intended, enacted and actual objects of learning do not coincide Koichu1, Zaslavsky, & Dolev (2015). Perhaps this forms the contrasting result in many mathematics classrooms where the teacher is convinced that he has taught a particular concept, yet the learners have a different understanding. Consequently, when the teacher extends and link other concepts to the previously intended object of learning, learners' mental construction is detached from making connections.

Methodology

Intervention

This study reports specifically on the data collected during the first intervention intended to address the gap incurred in the foundation phase mathematics learning because of absence of grade 1 and two teachers in a primary school in the Eastern Cape province of South Africa. This intervention was directed at exposing learners to working with basic shapes in geometry known as space and shape at their level. Learners were very much passionate about those classes to an extent that even if they were absent at school, they would not miss their intervention classes. Usually the intervention classes were conducted once a week every Wednesday afternoon from 4p.m to 5p.m. This is where they met, played and shared numerical competence skills with their peers. Nonetheless the administration of worksheets took place during the ten days Spring school vacation period in which the intervention class was conducted for an hour daily. Learners were committed to these classes. It is where they experienced restoration of their dignity with respect to gap closure in their mathematics skills. The facilitator was a retired teacher who monitored learners' progress. Learners in this homework class were conducted for a duration of one and a half hours during weekends with learners from five different neighboring primary schools registered for grade 1-5.

The study was located within an interpretivist paradigm, which seeks to understand the situation from the perspective of the participants (Ary, Jacobs & Razavieh, 2002). A qualitative research approach was followed in which structured worksheets covering mathematics content for grade 1-5 were prepared for the learners to practice after school. Although the worksheets exposed the learners to various sections of mathematics done in the

foundation phase this paper only reports on shifts in learners' understanding of geometric shapes. A sample of 23 learners participated in this study.

This study became significant after an ethical clearance was granted by UNISA ethics committee in 2017 on a project informed by Engaging with meaningful teaching and learning of mathematical concepts: A case of Mt Ayliff District.' During the visits to one of the schools in the district, it was observed that the grades 1 & 2 learners had no teachers and were sharing the same classroom with grade 3's. This indeed compromised their confidence in learning since they did not understand most mathematics content taught at that level. This is a characteristic common to many rural schools in the country. Most learners are left to wonder in those under-resourced classrooms without proper instruction. I argue in this paper that the void incurred in mathematics knowledge stains them with poverty of the mind. Edwards (2012) avers that as a result of inadequate instruction, learners suffer not only in their present states but also in their futures. This author further notes that individuals who receive unsatisfactory schooling often face unemployment, welfare, and low standards of living when they are adults. The concern in this article is the fact that when learners lack basic and foundational mathematics knowledge, they develop phobia in following lessons and instructional levels such that the subject remains a monster in their education. The consequence is that they then cannot qualify to enroll for careers reliant on mathematics in their future. Poverty cycle then prevails.

Worksheets covering mathematics content for grade 1-5 were prepared for the learners to practice after school. The facilitator was a retired community member whose duty in the project was to ensure that learning takes place in a conducive manner. Also the facilitator from time to time read out the questions loud to all learners in the intervention classroom. It is important to mention that the 23 learners who participated in this study attended and received tuition from different schools around the area. These learners' homes were housed in one location though.

The foundation phase in South African schools include learners in grades 1-3 while learners in grades 4-6 belong to the intermediate phase. According to the Curriculum and Assessment Policy Statement (CAPS), in the foundation phase learners are required to learn the following space and shape topics: understanding and appreciation of the pattern, precision, achievement

and beauty in natural and cultural forms focusing on the properties, relationships; orientations, positions; and transformations of two dimensional shapes and three dimensional objects (DoBE, 2012). Children develop the understanding of space and shape in a sequential hierarchical manner described in the first three Van Hiele levels of spatial understanding (Usiskin, 1982). Those are: Level 1 (Visualisation and recognition) where children are able to see that shapes are different, for example, a square and a triangle, but cannot explain why they are different, Level 2 (Analysis) in which children are able to name the properties that make up some shapes, and Level 3 (Abstraction) where children can classify shapes according to their properties, for example, a square is a type of rectangle. Data was collected through administration of worksheets to the learners, observations and interviews with 5 learners based on their responses and illustrations on the worksheets.

Results

Certain themes emerged from data collected during analysis. In the first activity learners were issued with different flat shapes in several colors and mixed shapes and were required to sort them. This was based on the principle that when children play with objects and draw them, they learn to understand geometry better. They were then given A4 size empty worksheets where they had to represent their sorted shapes. The following three illustrations were chosen and the learners were later interviewed on how they sorted their shapes. Also during the time of observation, the after school classes had been going on for more than six months.

It can be noticed that instead of sorting or grouping the given shapes according to similarity in shape and or color, Learner1 left out all the other shapes but chose a few significant ones. When asked how she did her sorting, he replied:

 Bendifuna ukwakha indlu, umama azohlala kuyo xa sendisebenza. (I wanted to build a small house for my mom when I work). *Ndeze I roof ngezi ezifanayo, ndathatha le ebomvu enkulu yaba ludonga lwendlu, ndabeka ifestile nomnyango ngaphambili.* (so I made a roof, and then took the red big shape to be the wall. I then placed a door and two windows in the front of my house.)

When I probed further to see if the learner knew the names of the shapes she used to build her hut, Learner 1 said:

'Lena ebomvu is a square' (The red one is a square).

Researcher: Why do you say so?

Learner 1: *Wonke amacala ayo ayalingana* (All its sides are equal).

I then picked up a rectangle, showed it to Learner 1 and asked: Is this a square?

Learner 1: *No, la macala wayo awalingani, ndingathi zizi square ezimbini ezihlangeneyo.* (No, its sides are not equal, I can say it is two squares joined).

Researcher: Why is it not a square?

Learner 1: *La macala ajongeneyo ayalingana*. The sides facing each other are equal.

Learner 1's response indicates that he could discern what is a square from what was not. He could only site one critical feature for a square but could not understand the fact that the square was also some form of a rectangle. The learner operated in the second level of Van Hiele since she could analyze by naming some properties of the shapes given to her.

Learner 2 chose only triangles and arranged them in her A4 size paper such that the enclosed figure was a square.

This learner did not indicate that he did not understand the instruction, but used and arranged his shapes to form what was appealing to his eyes. During interviews I asked him:

Researcher: How did you end up with this structure? (pointing at his presentation).

Learner 2: *Ndiye ndabona uba la matrayengile ayalingana, ndabeka afanayo uba ajongane.* (I could see that the triangles were equal, so I decided to arrange them such that those with the same color faced each other.) Probed further:

Researcher: So then what shapes have you formed in your presentation?

Learner 2: *Square here and triangles around.*

Researcher: How different are they?

Learner 2: *Three amacala e triangle and four awe square.*

It was also observed that learners from one school who were familiar with some of the mathematics concepts shared what they knew and taught their peers mathematical skills. They would also correct their work while showing them some other ways of doing calculations. The following extract indicates a grade 1 learner's work and how she was corrected.

Discussion

In conjunction with the first three Van Hiele levels of geometric thought, the growth of space and shape knowledge construction in this study was monitored. Nonetheless, the analysis in this paper follows themes identified as data was coded with guidance from the variation theory. It was alarming to know that this was the only time some of the learners from local

schools were exposed to mathematics learning. Each of the learners worked independently at first and then shared information as groups when they get the idea on how a mathematical problem could be tackled. This was a free environment that allowed learners to exercise their creativity without guidance or fear of doing things incorrectly. The importance was to restore their dignity and set their minds free while they own and experience learning.

Learner 1's response indicated not only the mathematics applications displayed by the learner but the cry and the anticipation the learner had to restore her dignity. The learner was not responding to the instruction given, perhaps did not even understand it, nonetheless used the platform to air out her frustrations with respect to the projections of what she wants in future, to disrupt the cycle of poverty signified by unbecoming conditions of structure in her life. This is in conjunction with Edwards (2012) who asserts that that the mind has the potential to change over time and enables one to understand how disadvantaged children can learn to think outside of their circumstances. This then filters to the brain that can deal with situations that are detrimental so as to take on conditions that are beneficial to grow the child's confidence for a defined future.

Figure 1: Learner 1's work

Figure 2: Learner 2's work

Learner 2's distinction indicates that the learners could separate the shapes and also name them. Also the construction of a closed figure could indicate the boundedness the learner wanted to experience in his life. The freedom given to the learners to sort the shapes in their own ways and describe how they see things without intimidation of being right or wrong,

indicates that their views are important. Their dignity is restored and confidence of tackling more problems in mathematics is greatly valued. This becomes the foundation for their brighter future and hope for breaking the trend of poverty surrounding them. Of much significance was the chance availed to them through the intervention classes to learn concepts in space and shapes. This helped them to be able to identify with their immediate environment as they connected what is learnt in the intervention class with what they already knew. The peer support they got from the learners who were taught in other local schools in the group, together with those in higher school grades, added to their knowledge constructions.

Further conversations with the learners revealed how they had big dreams to be engineers when they are old. There was also fear of the fulfillment of such wishes since they had no teachers to teach them in the first and second grades. As it was observed in figures 1 and 2, a number of learners used this exercise to represents beautiful huts that they wanted to build such that their home situations could improve. This concurs with D'Ámbrosio (2001) who asserts that when children describe the geometry of a building or how they construct an object, it is the first phase of a heritage restoration work. This implies that children try and connect with their culture and environment in picture representation.

Learner 3 presented the illustration represented in figure 3 instead of sorting the given shapes. During interviews, he described his illustration as a person's face, with forehead, two eyes, a nose and a mouth. He justified that he thought he must illustrate something different from other learners as he noticed that many children were representing huts.

Learner 4's illustration is represented in figure 4. There were two other illustrations from the whole group who sorted the given shapes according to similar shapes. This learner explained during interviews that he required another worksheet to be able to place the different triangles and squares he picked up from the shapes given to him. The learner was then asked to explain to the other learners how to sort the shapes. What it meant to sort shapes, but the learner went on to ask the other learners to identify similar shapes in their classroom. He took over the instruction in the class such that they ended up playing with shapes and describing their properties.
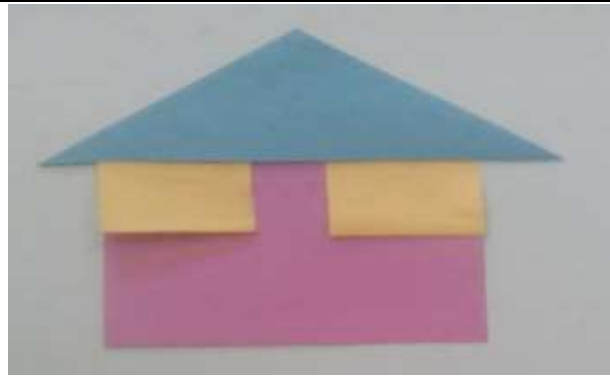
Fig 3: Learner 3's work,   **Fig 4: Learner 4's work**

Conclusion

The peer cooperative learning environments that prevailed amongst the learners was characterized by positive interdependence, individual accountability, open communication, and cooperation. This supported the intentionally formed peer group learning where the advanced learners assisted to close the knowledge gap amongst those who lacked. It can therefore be concluded that the creation of a supportive and caring environment can develop the learners' resilience, and increase interest together with their competence in understanding of basic mathematics concepts. The learners also develop good relationships with each other while they share information and help others to restore their dignity and lead them ultimately to independence of acquiring other mathematical skills and ownership of the learning experiences. The intervention with the after school programme may serve to break the cycle of poverty for the disadvantaged learners and restore their competence in understanding mathematics concepts. This breaks the cycle where learners are subjected to shame since they do not receive proper tuition in their schools due to absence of qualified teachers. The intervention classes expose learners to self-learning skills where they interact with the material and are assisted by other learners who understand certain mathematics skills. The gap in their knowledge is closed while they learn to share what they know with fellow learners. Although poverty cannot be eradicated in one method, rather it takes intervention strategies of this nature to restore confidence to learners, and providing platforms where informed and non-informed learners can work together to bring change in each other's lives. Moreover, the intervention classes introduced the children with the tools to be confident in their abilities to be academically successful, thereby breaking the cycle of poverty for them and their families. The disadvantaged learners without trained teacher's experiences may

have gaps, but through intervention classes their knowledge can be built while expanding their repertoire of skills and competencies.

References

Ary, D., Jacobs, L.C., & Razavieh, A. (2002). Introduction to research in education. Belmon CA: Wadsworth/Thomson Learning.

Brownell, W. A. (1935). Psychological considerations in the learning and teaching of arithmetic. In the teaching of arithmetic: Tenth yearbook of the National Council of Teachers of Mathematics. New York: Columbia University Press.

Bruner, J. S. (1960). The process of education Cambridge, MA: Harvard University Press.

D'Ambrosio, U. (2001). What is ethnomathematics, and how can it help children in schools? Teaching Children Mathematics; Vol. 7 (6) p. 308, Reston.

Dienes, Z.P. (1966). Mathematics in the primary school. London: Macmillan.

Edwards, S. (2012). The Effects of Poverty on Achievement Gap: A Quantitative Analysis Using Stratification Theory. Proceedings of the National Conference On Undergraduate Research (NCUR) Weber State University, Ogden, Utah March 29-31.

Gardiner, M. (2017). Education in rural areas. Issues in Education Policy Number 4. Centre for Education Policy Development (CEPD), Braamfontein, South Africa.

Gubrium, E., Pellissery, S. & Lødemel, I. (2014). The shame of it: global perspectives on anti-poverty policies. Bristol: Policy Press

Jeanty, J. (2008). The effects of poverty: Classroom. Purdue University. Leaf Group Ltd.

Gu, L., Huang, R., & Marton, F. (2004). Teaching with variation: A Chinese way of promoting effective mathematics learning. In L. Fan, N. Y. Wong, J. Cai, & S. Li (Eds.), How Chinese learn mathematics: Perspectives from insiders. Singapore: World Scientific Publishing.

Hawthorne, L. (2011). Constitution and Contract: Human Dignity, the Theory of Capabilities and Existenz grundlage in South Africa, 2011 Studia Universitatis Babes-Bolyai Jurisprudentia 27.

Kim, P., Evans, G. W., Angstadt, M., Ho, S. S., Sripada, C. S., Swain, J. E., Liberzon, I., & Phan, K. L. Effects of childhood poverty and chronic stress on emotion regulatory brain function in adulthood. Proceedings of the National Academy of Sciences, 2013; DOI: 10.1073/pnas.1308240110.

Koichu, B., Zaslavsky, O., & Dolev, L. (2013). Effects of variations in task design using different representations of mathematical objects on learning: A case of a sorting task. In C. Margolinas, J. Ainley, J. B. Frant, M. Doorman, C. Kieran, A. Leung, M. Ohtani, P. Sullivan, D. Thompson, A. Watson, & Y. Yang (Eds.), Proceedings of ICMI Study 22 Task Design in Mathematics Education (pp. 463–472). Oxford: Oxford University Press.

Lebech, M. (2009). What is Human Dignity? Faculty of Philosophy, National University of Ireland, Maynooth.

Leibovich, T., Katzin, N., Harel, M., & Henik, A. (2016). From 'sense of number' to 'sense of magnitude' :The role of continuous magnitudes in numerical cognition. Behavioral and Brain Sciences,; 1 DOI: 10.1017/S0140525X16000960.

Leung, A. (2003). Dynamic geometry and the theory of variation. In N. Pateman, B. Dougherty, & J. Zilliox (Eds.), Proceedings of the 2003 joint meeting of PME and PMENA (Vol.3, pp.197-204). Honolulu: University of Hawaii.

Ling, L. M., & Marton, F. (2012). Towards a science of the art of teaching: Using variation theory as a guiding principle of pedagogical design. International Journal for Lesson and Learning Studies, 1(1), 7–22.

Luby, J. L., (2015). JAMA Pediatrics. Science News, July Edition, MD, at Washington University School of Medicine in St. Louis.

Marton, F., & Booth, S. (1997). Learning and awareness. Mahwah, NJ: Erlbaum.

Murayama, K., Pekrun, R., Lichtenfeld, S. & vom Hofe, R. (2012). Predicting Long-Term Growth in Students' Mathematics Achievement: The Unique Contributions of Motivation and Cognitive Strategies.

O'Connor, E. E., Cappella, E., McCormick, M. P., & McClowry, S. G. (2014). Enhancing the academic development of shy children: A test of the efficacy of INSIGHTS. School Psychology Review, 43(3), 239-259.

Phan, K. L. (2013). University of Illinois at Chicago College of Medicine and senior author of the study.

Piaget, J. (1972). The child's conception of physical causality. (M. Gabain, Trans). Totowa, NJ: Littlefield, Adams. (Original work published 1927).

Reay, D. (2012). ''We never get a fair chance": working class experiences of education in the twenty-first century'. In: W. Atkinson, S. Roberts and M. Savage (eds) Class inequality in austerity Britain. Basingstoke: Palgrave.

Runesson, U. (2005). Beyond discourse and interaction. Variation: A critical aspect for teaching and learning mathematics. The Cambridge Journal of Education, 35(1), 69–87.

Spaull, N. (2013). South Africa's Education Crisis: The quality of education in South Africa 1994-2011: Report Commissioned by CDE October 2013.

Timaeus, I., Simelane, S., & Letsoalo, T. (2011). Poverty, race, and children's progress at school in South Africa. Policy Brief: School of Development Studies, University of KwaZulu-Natal.

Usiskin, Z. (1982). Van Hiele levels of achievement in secondary school geometry: CDASSG Project, Chicago University.

Vygotsky, L. S. (1987). Collected Works of L. S. Vygotsky, Vol. 1: Problems of General Psychology, trans. Norris Minick, New York.

GENDER PARITY AND ICT INTEGRATION IN EDUCATION: A SOUTH AFRICAN PERSPECTIVE

Keshnee Padayachee

University of South Africa

padayk@unisa.ac.za

Abstract

This study aims to determine if there is a difference between males and females with respect to ICT (Information Communication Technology) integration in classrooms among South African teachers. This study involved a secondary analysis of a primary data set (n=122), containing qualitative and quantitative data leveraging an active-learning perspective for the incorporation of ICT in the classroom. The quantitative data revealed that there are few statistical differences between the genders with respect to their ICT usage in the classroom. The qualitative data suggests that each gender is attracted to different attributes in technology. Female teachers prefer content-driven tools whereas males are galvanized by ICT infrastructure and hardware.

Keywords: Information Communication Technology (ICT) Integration, Gender, Education

1. INTRODUCTION

There is evidence that ICT (Information Communication Technology) tools can be an effective means in supporting teaching and learning such as leveraging online collaborative tools to support group interaction. While the pedagogical and technical expertise of the teachers is crucial to the success of ICT integration in the classroom (Hennessy, Harrison, & Wamakote, 2010), the influence of ethnic culture may also be a contributing factor (Gardner, Sheridan, & Tian, 2014). Consider the study by Drossel, Eickelmann, and Gerick (2017) on secondary school teachers (n=8920) on the predictors including gender that would determine the frequency of computer use in classrooms across five countries. They found that female teachers show a higher frequency of ICT integration in the classroom in the Netherlands while males showed a higher frequency of ICT usage in Poland and Germany. There was no significant difference for countries such as Denmark and Australia. This study suggests that the notion that gender may influence the ICT integration in the classroom may vary among countries. Hence, it is significant to obtain various perspectives across various cultures in

order to attain a nuanced picture of the phenomenon. This article explores the impact of gender on the teachers' integration of ICT in South African classrooms. Further, there is a paucity of studies in South Africa that reflect on the frequency of ICT usage with respect to gender. Additionally, there is little emphasis on whether the ICTs are presented in a form that can meet the information challenges of women in developing countries (Hafkin, 2002).

Males have in the past given preference with respect to ICT decision making and consequently 'studying gender gaps is significant both because of the effect on teachers and the effect that teachers' attitudes towards computing technology have on future generations of teachers and technology professionals' (Steele, 2006, p. 1). According to the ITU (2016), the 'global Internet user gender gap grew from 11% in 2013 to 12% in 2016 whereas the regional gender gap is largest in Africa (23%) and smallest in the Americas (2%). The gender gap has the power to influence whether women in Africa will be future leaders in technology or not. By all accounts, it appears that African women are lagging behind their western counterparts. Obtaining deeper insights into ICT usage in this context will inform policy and help develop better guidelines to assist teachers in ICT usage in the classroom.

There are a few studies that consider the use of ICTs in higher education (Brown & Czerniewicz, 2017; Czerniewicz & Brown, 2005), school learner computer attitudes (Bovée, Voogt, & Meelissen, 2007) and school learner ICT competence (Gudmundsdottir, 2010) in relation to gender among other factors in South Africa. However, there is a need for studies that consider the depth and breadth of the actual usage of digital tools among school teachers from a gender perspective in South Africa. This is a significant research problem, which needs addressing, as initiatives towards ICT Integration can only be successful in encouraging teachers if they can identify and understand the influence of gender on ICT adoption. This leads to the main problem of the study addressed by this research namely: *To what extent does gender affect the ICT Integration in the classroom?* To tackle this research question systematically, this study drew upon data collected by a previous study (i.e. a secondary analysis) by the author, which aimed to determine the extent of ICT integration in South African schools.

2. THEORETICAL FRAMEWORK

The framework of Technological Pedagogical Content Knowledge (TPACK) has been widely suggested as a necessity for teachers in order to apply ICT integration in the classroom

successfully. In addition, Padayachee and Mbati (2016) suggested that envisioning the model from a pragmatic perspective such as active learning can be more meaningful to show how 'ICT engages the constructive dimension within active learning' (Koh, 2013, p. 889) due to the convoluted nature of the model. This framework has been applied previously by Padayachee (2017a). Consequently, the conceptual framework proposed is based on an active-learning perspective for the incorporation of ICT in the classroom. This framework can ease the understanding of the specific categories of knowledge base required for teachers. Using the practical steps of Fink (2003), who proposed a holistic model of active learning, may lead to greater acceptance of technology-enabled active learning. This study considers the use of ICT tools along the following dimensions – experiential learning tools, reflective dialogue tools, content-driven tools and contextual tools.

The experiential learning activity involves rich learning experiences by doing or observing activities that are either authentic or simulated. According to Kolb (2015), experiential learning is characterized by rich learning experiences which supports reflecting, thinking and acting. 'Experiential Learning rests with the student and does not necessarily require a teacher' (Itin, 1999, p. 92). Tools that require interaction would fall under the experiential activity type. Examples include: virtual labs; statistical software; spreadsheet software; software referencing packages; software for qualitative text analysis; search engines; online examinations/tests; multimedia-based learning software; internet-based learning platforms; graphic software; free multimedia-based learning software from the internet (e.g. simulations, animations); e-portfolios; educational computer games and computer simulations.

The reflective dialogue activity type involves self-reflective or collaborative reflection about the subject and/or learning process (Fink, 2003). This category of tools that involves collaborative reflection or self-reflection would be considered as being reflective dialogue tools. Examples include: online internal forums/newsgroups; mailing lists; virtual seminars/webinars; social media; online slide sharing communities; blogs; 3D virtual worlds; collaborative project tools; mobile learning tools and applications and class wikis.

Fink (2003) suggested including the concept of 'getting information and ideas' (designated Content-driven tools) which can be seen as more passive within the ambit of active learning. In a content delivery mode, the student passively receives knowledge (Patil, Mhatre,

Kumawat, & Ghodeswar, 2018). Examples of content-driven learning activities facilitated via ICTs include: self-created websites; word-processing programs; video editing software; video/record lessons; presentation software; podcasts/vodcasts; online video sharing sites; online library services; file sharing; downloadable e-books and electronic texts and audio software.

One additional category was included, which is orthogonal to the activity type, is the contextual tools category, as some tools are not used for a specific type of activity. This includes aspects such as hardware and the network infrastructure, which forms the context in which the activities are carried out. Examples of tools used to facilitative an activity include data projectors, bring your own device (smartphones, tablets etc.), remote access (electronic resources) which refers to the use of electronic resources via computer networks, direct access (e.g. CD-ROMs) and interactive whiteboards.

The activities of experiential learning and reflective dialogue are more learner-centered while the content-driven tools are teacher-centered. This guideline for Technologically Enhanced Active Learning will be used as a lens to interpret the results of the study.

3. LITERATURE REVIEW

Hughes, Schilt, Gorman, and Bratter (2017) found that there were four primary frames for the dearth of women in science fields: historical bias, innate gender differences, socially constructed differences, and body clock versus tenure clock. The historical bias can be attributed to the view of science as a masculine domain. In an empirical study that considered the gender dimensions of ICT access and usage across 17 African countries including South Africa, it was found that the greatest limitation to equitable access to ICTs lies in 'cultural and social dimensions of what are considered by many as normal social practices' and 'gendered perceptions' (Gillwald, Milek, & Stork, 2010, p. 29). Females tend to see technology as a tool while males see technology as a 'toy' and this viewpoint can lead to females being socially excluded (Kelan, 2007).

Nikolopoulou and Gialamas (2016) conducted a study on secondary school teachers (n =119) with respect to teachers' perceptions of barriers to using computers in the classroom. Three barrier-factors were extracted: 'lack of support', 'lack of confidence' and 'lack of

equipment'. Female teachers perceived the lack of support as a major barrier. The study also found that confidence within technology was higher for male teachers. There are three gender-specific barriers as to why females do not identify with the ICT domain namely 'computer-related self-efficacy', 'pedagogical approaches to technology instruction', and 'cultural stereotypes of computer expertise' (Steele, 2006). These barriers are highly relevant to understanding why female teachers have less confidence in using ICTs in the classroom and this influences the successful integration of ICTs in the classroom.

Teachers with high levels of self-efficacy typically use computers more often and experience less anxiety when working with computers (Sang, Valcke, Van Braak, & Tondeur, 2010). Self-efficacy appears to be a major barrier to females' use of ICT integration in the classroom. Gandhi and Lynch (2017) conducted a study on (n=145) teachers from schools in Bangkok and they found that while both males and females had high levels of competence in ICT, males had a more positive attitude and a higher perceived self-confidence than females. They also found that males are more eager to use 'gadgets' which improve their self-efficacy. Hong and Koh (2002)'s empirical study involving Malaysian teachers (n=200) found that females are more anxious towards computer hardware than males. However, while other studies find that there is no correlation between self-efficacy and gender
(Baturay, Gökçearslan, & Ke, 2017; Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017; Sang et al., 2010).

The second barrier that may influence the use of ICT integration in the classroom is the cultural stereotyping of the genders. Nass, Moon, and Green (1997) conducted a study to determine whether computers with minimal gender cues can evoke stereotypical responses. They found that the tendency to gender stereotyping was so strong, such that it extended to computers. Often aspects such as programming are considered masculine while, using PowerPoint presentations are considered feminine (Casula & De Feo, 2016). Males and females can differ in the way they communicate about technology. For instance, females prefer the assistance of other females when requiring technical help (Steele, 2006). Studies suggest that male and female teachers are attracted to different attributes of technology and do not share the viewpoint of how it should be used, and these differences need to be taken into account during technology decisions, training and professional development (Heafner,

2014). However, not all studies find significant differences with respect to genders and their attitude towards using technology (Shapka & Ferrari, 2003).

The third barrier is related to pedagogical issues. Female teachers are highly concerned about how they will integrate ICTs into a lesson. Siddiq and Scherer (2016, p. 18) considered the moderating effects of gender on a sample of Norwegian secondary school teachers (n = 1071) and found that females have 'lower confidence in their technological pedagogical content knowledge'. Alghamdi and Higgins (2015) conducted a study on Saudi Arabian primary school teachers (n =587) with respect to their attitude towards interactive whiteboards. They found that females preferred learning more about pedagogy in relation to whiteboards and preferred self-training. Koh and Chai (2014) found that female teachers were less confident in their abilities with respect to the confluence of technological, pedagogical, and content knowledge.

There are limited studies that have considered the topic of gender and ICT integration within the South African context at school-level. Consequently, the next discussion will consider gender-related studies within the South African e-education landscape. Czerniewicz and Brown (2005) conducted a study on higher education institutions (6 577 students and 515 academics) in the Western Cape considering the extent to which ICTs are used in teaching and learning. They found that male students use computers more often for recreation and finding information than females. However, this difference did not translate 'in frequency or type of use for teaching and learning activities' (p. 15) for both students and staff. Bovée et al. (2007) conducted a study on computer attitudes (n=240) of students from primary and secondary schools in South Africa. The results of the study showed no differences in attitudes between the genders. However, the findings of the study showed differences among socioeconomic backgrounds, where upper/middle-class students were more positive toward computers. Gudmundsdottir (2010) considered the digital divide across four schools in Cape Town, among seventh-grade learners (n = 290) where each learner's ICT competence was compared in relation to gender among other factors. the study revealed no significant differences and this was attributed to learners having less home access versus all learners having access at school, regardless of gender (Gudmundsdottir, 2010). The Brown and Czerniewicz (2017) study involving university students (n=10110) found differing patterns of learning among genders which appear to be context-dependent as this is related to life

histories and circumstances. Clearly, there is a need for more empirical studies to be conducted within the South African context.

4. RESEARCH METHODOLOGY

The secondary analysis used in this paper is based on data collected as part of a larger study from several schools in Tshwane South as an outcome of a previous study by the author (Padayachee, 2017b), which involved a non-experimental exploratory research design. The purpose of the original study, which involved the frequency of usage of ICT tools in the classroom, is maintained except that the analysis is done per gender rather than per school. Accordingly, the null hypothesis is:

H_0: *The hypothesis that there is no difference in the frequency of usage of ICTs between Male and Female teachers is true.*

The sampling strategy for collecting the primary data represented a combination of convenience and purposive sampling. The sampling criteria considered an intersection of areas of relatively high access to the internet in 34 top performing high schools in 2015 (based on the national senior certificate examination) in Tshwane South. (Note: one school was comprehensive by including learners of all grades). The questionnaire was administered to 551 teachers and 124 teachers responded. Two participants were excluded due to incomplete responses. Therefore, the secondary analysis considered the responses from 122 teachers.

The instrument used to collect the primary quantitative data consisted of two sections. Section 1 elicited the respondents' demographic data (i.e. age, qualifications, gender, and subject expertise). Section 2 contains two structured questions. These questions were adapted from Zawacki-Richter, Müskens, Krause, Alturki, and Aldraiweesh (2015). The secondary analysis is based solely on the first question was which elicited the frequency of usage of 40 digital tools (which were assessed by means of five-point Likert-scales (1=several times daily…5=never)) and the demographic data. The primary qualitative data which was derived from a few open-ended questions adapted from Graham, Burgoyne, Cantrell, Smith, St Clair, and Harris (2009) was included in the secondary analysis. These questions considered the usage of digital technologies and possible barriers to the use of ICTs.

The tests for validity for the primary data included face validity and content validity. To ensure face and content validity the resulting survey was evaluated for clarity and correlation to research objectives by a statistician and a subject matter expert. The survey developed for the original research was also validated. Triangulation of the quantitative data and qualitative data can help validate and confirm the results. As the originator of the research was involved in the primary study the credibility of the data was assured. This study involved a sample size of 122 teachers, which may not be large enough to generalize on the teacher population in South Africa and was limited to Tshwane South.

5. DATA ANALYSIS

Statistical analysis was performed using SPSS (Statistical Package for Social Sciences) while the qualitative data was coded according to themes in Atlas ti. The study involved 95 females and 27 males.

5.1. Quantitative Analysis

A paired t-test revealed that there is no significant difference between males and females (mean 3.96397 (female) vs 3.728036 (male) (t = 5 25.37; p = 0.221731; df = 78). As the p-value (> 0.05) is high this indicates that there is insufficient evidence to suggest the null hypothesis is false. From the analysis of the study, a few notable implications can be drawn. A Pearson Chi-square test was performed for comparison of the frequency of usage of digital tools per gender in order to identify specific differences. With respect to *experiential tools,* it was shown that significantly more males used internet learning platforms than females (M = 2.95 vs M = 3.93 χ^2 = 11.325, P = 0.023). It was also shown that more males use graphic software than females (M = 3.74 vs M = 4.22 χ^2 = 12.043, P = 0.017). There were no statistical differences between the males and females here with respect to *reflective dialogue tools*. Most tools are used more frequently by males except for virtual seminars/webinars and social media. Males tend to favour using *contextual tools,* however, there are no significant differences. With respect to *content-driven tools*, most of the tools are used more frequently by males except for downloadable eBooks and electronic texts, podcasts, and word-processing programs. Also, significantly more males used online video sharing sites than females (M = 3.04 vs M = 3.79 $\chi2$ = 11.130, P = 0.025).

5.2. Qualitative Analysis

The qualitative analysis was based on the responses to the open-ended questions. In response to the question that aimed to determine which tools are currently used to support teaching, females preferred content-driven tools (44%), while males preferred contextual tools (39%) and content-driven tools (39%) in the same measure. The number of observations and frequencies (calculated as a percentage of the total observations) is summarized in Table 1.

Table 1: Current Usage of ICT Tools in the Classroom

TYPES	Female		Male		Totals
	# observations	Frequency	# observations	Frequency	
Collaborative Tools	6	5%	2	6%	8
Contextual Tools	28	25%	14	39%	42
Experiential	30	26%	6	17%	36
Content-driven Tools	50	44%	14	39%	64
Totals	114	100%	36	100%	150

A deeper analysis per tool reveals that the tools mentioned most frequently by females include (above the 5th percentile): presentation software (25%), data projectors (19%), search engines (17%) and online video sharing sites (13%). The most frequently mentioned tools by males include (above the 5th percentile): presentation software (23%), data projectors (19%), online video sharing sites (9%), interactive whiteboards (7%) and downloadable ebooks/electronic texts (7%). The qualitative survey revealed that usage of the aforementioned tools appears to be fairly evenly distributed between males and females except for search engines. It appears that females are more likely use the internet to source information.

In response to the question which aimed to determine the barriers to using technology in the classroom, the males and females highlighted the lack of access/resources as the core problem. The second prominent issue is the lack of funding and the lack of skills and these appeared to be of more concern to females than to males. Females were concerned about the lack of support. Cases in point include: "Our network is not always working well at school and the IT support is very poor". (#F73) and "Financial – schools cannot always supply support digital technologies, Training" (#F94). Females appear to be highly concerned about

technical issues. Cases in point include: **"**There are too many programs, which speedily undergo changes" (#F12) and "Technology sometimes fail to work and it takes time to set up" (#84). Comparatively only one male participant complained about the technical issues. A case in point: "It distracts children. They use it for other purposes! The technology may be too complicated. Difficulties bring the whole class to a standstill" (#M10). Notably, females appeared to be concerned about the lack of resources for indigenous languages. Cases in point include: "I teach Afrikaans, Not all digital programs can be used, limited Afrikaans resources" (#F90) and "Very little information on Sepedi Home Language" (#F95).

In response to the question that aimed to determine the nature of technologies that teachers would envision using if there were no barriers, the largest differences were found between content-driven tools (7% vs 37%) where females scored higher and contextual tools (57% vs 28%) where males scored higher. The differences between the other tools were negligible. The envisioned tools were compared against the current usage to identify any shift in patterns. The relative frequency per category per gender with respect to current and envisioned usage is demonstrated in Figure 1

Figure 1 demonstrates that males envision themselves using contextual tools much more (39% to 57%) and males also envision using experiential tools more (17% to 29%) in the future. However, males envision using content-driven tools much less (39% to 7%) in the future. On the other hand, females envision using content-driven tools the most but relatively less as compared to current usage (44% down to 37%). Males have a preference towards contextual type tools.
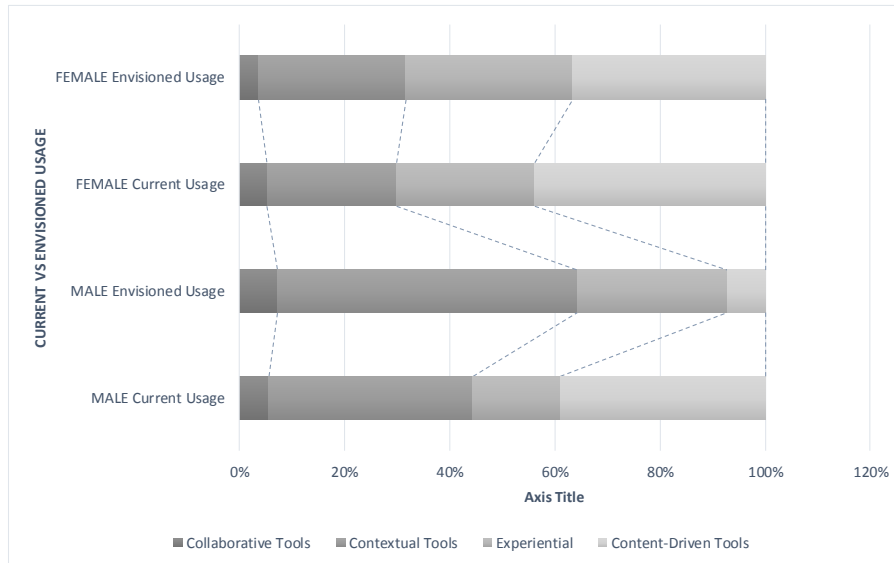
Figure 1: Relative Frequency of Observations per Gender with respect to Current and Envisioned Usage of Tools

Females offered a proposition by stressing the importance of Communities of Practices towards eliminating barriers. Cases in point include: "I would show tutorials on how to solve problems to hear from other teacher's perspective" (#F8); "Interactive online support from other teachers (online services)"(#F31); "Videos for background into sharing info between teachers at the moment available but not used" (#F69); "I would make use of file sharing with fellow teachers and students." (#F74) and "Connect to other classes + schools worldwide + sharing of good practice" (#F82).

In the overall analysis, males tend to use most tools more frequently than females.

6. DISCUSSION

Based on the quantitative research male teachers used most tools more frequently on average than females (experiential tools (M = 3.76 vs M = 4); reflective dialogue tools (M = 4.07 vs M =4.23); content-driven tools (M= 3.645 vs M = 3.88); contextual tools (M = 3.14 vs M =3.45)). However qualitatively, females gravitate more towards content-driven tools than males. Males appear to be more attracted to contextual tools (i.e. hardware) than females. This may reflect the findings of Hong and Koh (2002) who found that females are more anxious about computer hardware than males. Although males gravitated toward contextual tools, their envisioned usage showed that they would like to gravitate more towards

experiential tools and less towards content-driven tools in the future while females envisioned gravitating more towards content-driven tools albeit slightly less than their current usage. This finding appears to support the conclusions of Heafner (2014) that females considered technology as a means to engage directly with learners. In order for females to see the value of ICTs, they need to consider more learner-centric tools such as experiential tools which promote learner autonomy.

While this current study found few significant differences overall, there were significant differences among specific tools in favour of males using them more frequently; these included e-learning platforms, graphic software and online sharing sites such as YouTube. However, this could be due to self-efficacy issues of females, which was identified during the qualitative analysis. Similarly, Alghamdi and Higgins (2015) found that female teachers were less confident in their abilities than male teachers. There was no evidence of cultural stereotyping in the study, however, there may be contrasting views on the use of technology in learning. Heafner (2014, p. 411) found that there is a distinct 'contrasting view of technology as an end (tool) to a means (historical/critical thinking) rather than a means (process for assessing new information) to an end (creating new pathways of relevance)'. They found that females view internet usage as a primary source of information but they do not employ the 'historical thinking' of males. Males view technology as a tool to build and model learning. This may explain why males in the current study used e-learning platforms, graphic software and online sharing sites such as YouTube significantly more than females. The usage of tools appears to be fairly distributed between the males and females except for search engines. In this study, it was found that females are more likely to use the internet to source information, which implies that females view technology as a process for acquiring new information. A way to gain more material that is content-based.

Heafner, Groce, Bellows, Coffey, and Bjerre (2015) suggest that professional development should challenge gender perceptions and that experiences should not be male-dominated but that there should be a female voice. Females are concerned that they cannot keep up with technology. Similarly, in this study, it was found that females complained about the age gap and called for a community of practice approach to upgrade their skills. Females would like to learn and share experiences. It is clear that females are concerned about how to combine pedagogy, technology, and content effectively. They are looking for exemplars of teaching

with technology to learn from, hence the call for communities of practice. Remarkably while females are concerned about their own inadequacies, males are concerned about the inadequacies of the learners. Males are more concerned about the students not meeting the demands of ICT integration (lack of resources, lack of skills and discipline). The male teachers who are concerned about the learners' inadequacies, appear to support Heafner (2014) who found that male teachers want tools that encourage student autonomy.

7. CONCLUSION

This article examined the gender differences and ICT (information and communication technology) competency. Quantitative analysis was applied to a statistical data set collected in the context of a study with teachers (n=122) conducted in South African High Schools in 2016. Findings from this study show that there were few statistically significant differences with respect to ICT usage per gender. However, the qualitative study revealed that each gender may have dissimilar concerns regarding their use of technology in the classroom and may gravitate towards different categories of tools. The author proposes a professional development programme with a learner-centric approach which may be the catalyst for successful ICT integration in the South African classrooms. The idea of using reflective dialogue tools and experiential tools to deliver content engages insight in the intersection of technological and pedagogical knowledge and should be the aim of promoting a learner-centric environment. This approach may result in greater technology acceptance among female teachers. Further research may involve considering the influence of learner-centric approaches on ICT acceptance.

REFERENCES

Alghamdi, A., & Higgins, S. (2015). Investigating how teachers in primary schools in Saudi Arabia were trained to use interactive whiteboards and what their training needs were. *International Journal of Technical Research and Applications, Special Issue, 30*, 1-10.

Baturay, M. H., Gökçearslan, Ş., & Ke, F. (2017). The relationship among pre-service teachers' computer competence, attitude towards computer-assisted education, and

intention of technology acceptance. *International Journal of Technology Enhanced Learning, 9*(1), 1-13.

Bovée, C., Voogt, J., & Meelissen, M. (2007). Computer attitudes of primary and secondary students in South Africa. *Computers in Human Behavior, 23*(4), 1762-1776.

Brown, C., & Czerniewicz, L. (2017). Making sense of Gender and ICTs in Education: Exploring theoretical explanations for complex findings. Retrieved from http://open.uct.ac.za/bitstream/handle/11427/24694/Brown_Gender_ICTs_Education.pdf?sequence=6

Casula, C., & De Feo, A. (2016). Education 2.0 and Gender: A Case Study on the Use of Interactive Whiteboards in Secondary Schools. *Italian Journal of Sociology of Education, 8*(2), 143-169. doi:10.14658/pupj-ijse-2016-2-7

Czerniewicz, L., & Brown, C. (2005). The uses of information and communication (ICT) in teaching and learning in South African higher education practices in the Western Cape: research: information and communication technologies. *Perspectives in Education, 23*(1), 1-18.

Drossel, K., Eickelmann, B., & Gerick, J. (2017). Predictors of teachers' use of ICT in school – the relevance of school characteristics, teachers' attitudes and teacher collaboration. *Education and Information Technologies, 22*(2), 551-573. doi:10.1007/s10639-016-9476-y

Fink, L. D. (2003). A self-directed guide to designing courses for significant learning. *University of Oklahoma, 27*, p11.

Gandhi, H. K., & Lynch, R. (2017). A Comparative Study of Teachers' Knowledge of Common ICT Software, Their Perceptions towards Using ICT and Their Perceived Self-Confidence in Integrating ICT in Their Classes According to Gender in Two International Schools in Thailand. *Scholar, 8*(2), 78-93.

Gardner, L., Sheridan, D., & Tian, X. E. (2014). *Perceptions of ICT: An Exploration of Gender Differences*. Paper presented at the EdMedia: World Conference on Educational Media and Technology 2014, Tampere, Finland. https://www.learntechlib.org/p/147492

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J.-J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. *Computers in Human Behavior, 68*, 441-449.

Gillwald, A., Milek, A., & Stork, C. (2010). Gender assessment of ICT access and usage in Africa. *Towards Evidence-based ICT Policy and Regulation, 1*(5).

Graham, R., Burgoyne, N., Cantrell, P., Smith, L., St Clair, L., & Harris, R. (2009). Measuring the TPACK confidence of inservice science teachers. *TechTrends, 53*(5), 70-79.

Gudmundsdottir, G. B. (2010). From digital divide to digital equity: Learners' ICT competence in four primary schools in Cape Town, South Africa. *International Journal of Education and Development using Information and Communication Technology, 6*(2), 1H.

Hafkin, N. (2002). *Gender issues in ICT policy in developing countries: An overview.* Paper presented at the UN Division for the Advancement of Women Expert Group Meeting on Information and Communication Technologies and Their Impact On and Use as an Instrument for the Advancement and Empowerment of Women, Seoul, Republic of Korea.

Heafner, T. L. (2014). *Gender Differences in Technology Integration.* Paper presented at the Society for Information Technology & Teacher Education International Conference, Chesapeake, VA.

Heafner, T. L., Groce, E., Bellows, E., Coffey, H., & Bjerre, M. E. (2015). High School Teachers' Gender-Oriented Perceptions of Technology Integration *Exploring the Effectiveness of Online Education in K-12 Environments* (pp. 385-429): IGI Global.

Hennessy, S., Harrison, D., & Wamakote, L. (2010). Teacher factors influencing classroom use of ICT in Sub-Saharan Africa. *Itupale online journal of African studies, 2*(1), 39-54.

Hong, K.-S., & Koh, C.-K. (2002). Computer anxiety and attitudes toward computers among rural secondary school teachers: A Malaysian perspective. *Journal of Research on Technology in Education, 35*(1), 27-48.

Hughes, C. C., Schilt, K., Gorman, B. K., & Bratter, J. L. (2017). Framing the Faculty Gender Gap: A View from STEM Doctoral Students. *Gender, Work & Organization, 24*(4), 398-416.

Itin, C. M. (1999). Reasserting the philosophy of experiential education as a vehicle for change in the 21st century. *Journal of experiential Education, 22*(2), 91-98.

ITU. (2016). ICT facts and figures 2016. Retrieved from www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf

Kelan, E. K. (2007). Tools and toys: communicating gendered positions towards technology. *Information, Community and Society, 10*(3), 358-383.

Koh, J. H. L. (2013). A rubric for assessing teachers' lesson activities with respect to TPACK for meaningful learning with ICT.

Koh, J. H. L., & Chai, C. S. (2014). Teacher clusters and their perceptions of technological pedagogical content knowledge (TPACK) development through ICT lesson design. *Computers & Education, 70*, 222-232.

Kolb, D. A. (2015). *Experiential learning: Experience as the source of learning and development*. Upper Saddle River, New Jersey: Pearson Education, Inc.

Nass, C., Moon, Y., & Green, N. (1997). Are machines gender neutral? Gender-stereotypic responses to computers with voices. *Journal of applied social psychology, 27*(10), 864-876.

Nikolopoulou, K., & Gialamas, V. (2016). Barriers to ICT use in high schools: Greek teachers' perceptions. *Journal of Computers in Education, 3*(1), 59-75.

Padayachee, K. (2017a). The myths and realities of Generational Cohort Theory on ICT Integration in Education: A South African Perspective. *The African Journal of Information Systems, 10*(1), 54-84.

Padayachee, K. (2017b). A Snapshot Survey of ICT Integration in South African Schools. *South African Computer Journal, 29*(2), 36-65.

Padayachee, K., & Mbati, L. (2016). *A Guiding Vision of Technology-Enabled Active Learning A South African Perspective* Paper presented at the 2016 Annual Global Online Conference on Information and Computer Technology (GOCICT), Virtual Conference. https://sites.google.com/site/keshneepadayacheeprofile/file-cabinet/TEAL_Padayachee_Mbati_October10edited.pdf?attredirects=0&d=1

Patil, M., Mhatre, A., Kumawat, D., & Ghodeswar, A. (2018). Effective Integration of E-Learning and Social Platform: An Overview of the Practice at ACE. *Journal of Engineering Education Transformations*. doi:10.16920/jeet/2018/v0i0/120954

Sang, G., Valcke, M., Van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education, 54*(1), 103-112.

Shapka, J. D., & Ferrari, M. (2003). Computer-related attitudes and actions of teacher candidates. *Computers in Human Behavior, 19*(3), 319-334. doi:https://doi.org/10.1016/S0747-5632(02)00059-6

Siddiq, F., & Scherer, R. (2016). The relation between teachers' emphasis on the development of students' digital information and communication skills and computer self-efficacy: the moderating roles of age and gender. *Large-scale Assessments in Education, 4*(1), 17. doi:10.1186/s40536-016-0032-4

Steele, H. (2006). *The "gender gap" in computing: Implications for teacher education*. Paper presented at the Society for Information Technology & Teacher Education International Conference 2006, Orlando, Florida, USA. https://www.learntechlib.org/p/22147

Zawacki-Richter, O., Müskens, W., Krause, U., Alturki, U., & Aldraiweesh, A. (2015). Student Media usage patterns and non-traditional learning in higher education. *The International Review of Research in Open and Distributed Learning, 16*(2), 136-170.

RETHINKING TEACHING AND LEARNING IN THE 21ST CENTURY: COURSE DESIGN CHARACTERISTICS TOWARDS INNOVATIVE BEHAVIOUR

Leila Goosen[1] & James K Ngugi[2]

[1]Department of Science and Technology Education, University of South Africa

[2]Institute for Science and Technology Education, University of South Africa

Abstract

Research introduced several factors promoting Innovative Behaviour (IB) among employees. However, the effect of Course Design Characteristics (CDC) in developing IB among Information Technology (IT) students in universities is not well-understood. The purpose of the study was developing a Structural Equation Model (SEM) of the drivers of IB among IT students. Although universities developed strategies to stimulate students' innovative competencies, no measure exists of the innovativeness of students undertaking undergraduate IT studies: Very little research exists simultaneously exploring the determinants of undergraduate students' IB. The study aims to address this gap by examining how CDC act as a significant antecedent of IB, via the mediating action of Knowledge Sharing Behaviour (KSB). The subjects of the cross-sectional, quantitative, explanatory survey were 248 undergraduate students enrolled in IT programmes from seven public universities in Kenya. Data collection was conducted using a questionnaire. A 2,000-bootstrap sample was generated to test the standardized total, direct and indirect effects. The findings are summated in a KSB-IB SEM, with the aid of Analysis of Moment Structures software. The findings lent support to the positive effect of CDC in fostering technology students' IB. The indirect relationship between CDC and IB was significantly and fully mediated by KSB. The results of the study also revealed that CDC act as a significant driver of KSB and IB among undergraduate technology students. Further, this study provides key recommendations for managers involved in university education, on how to leverage the attributes of CDC at individual and contextual level, triggering IB.

1. Introduction

Research, for example, Hakimian, Farid, Ismail and Nair (2016), Kleysen and Street (2001), Li and Hsu (2017), Molodchik, Krutova and Molodchik (2016) and Sethibe and Steyn (2017), introduced several individual and contextual level factors that promote Innovative Behaviour (IB) among employees. However, the effect of Course Design Characteristics

(CDC) in facilitating the development of IB among Information Technology (IT) students in universities is not well understood. One of the study objectives is to address this literature gap by examining how CDC act as a significant individual and contextual antecedent of IB, via the mediating action of Knowledge Sharing Behaviour (KSB).

1.1 Background

Universities have established and invested in a variety of measures - see e.g. Ngugi and Goosen (2018) - with a view to helping students acquire innovative competencies, and be better prepared to succeed and adjust to the world of work. However, the effectiveness or usefulness of such ventures has remained at least questionable. The underlying quest to promote and enhance undergraduate innovative behaviour, has informed this study. Further, there is a paucity of literature on the individual and contextual drivers of undergraduates' innovative tendencies, specifically from a cross sectional point of view.

An examination of individual innovation among technology students should enhance our understanding of the significant drivers that shape innovative behaviour in the context of university education. Consequently, the present study sought to address this literature gap by exploring the individual and contextual determinants of technology students' innovative behaviour. This study contributes by extending the thinking of technology students' innovative tendencies, by applying the study job analogy advanced by Tuomi, Aimala, Plazar, Starčič and Žvanut (2013). Specifically, it is hypothesized that CDC foster technology students' innovative behaviour. Informed by the literature in self-regulation, job design and knowledge sharing, the study explored whether CDC exerted an effect on IB, mediated by KSB.

1.2 Problem statement

To better understand how KSB and its individual and contextual antecedents influence the propensity for IB, this study sought to generate a Structural Equation Model (SEM) to elucidate the complex nature of such relationships. The model generated should help to delineate the relationships between the individual and contextual level antecedent of IB (CDC), as well as the mediating role of KSB.

The model sought to answer pertinent questions in the field of innovation research in at least four (4) ways. Firstly, there has been a paucity of studies that seek to verify the dynamic

inter-relationship between the individual and contextual factors, which act as drivers of IB, especially in a university education context. Secondly, to the researcher's knowledge, there are no existing empirical studies that have examined how CDC may influence KSB and IB in an undergraduate university context.

Thirdly, the study sought to simultaneously test the individual and contextual antecedents of KSB on the IB context, by an examination of the direct and indirect effects, while adopting the procedure set out by Iacobucci, Saldanha and Deng (2007). Finally, the research breaks into new ground by contributing to course design literature, by proposing and modelling a new measure termed by the researcher as Course Design Characteristics (CDC), and examining how it influences students' IB. The study sought to validate if the proposed CDC scale is indeed an internally consistent measure in the university education context.

1.3   Purpose of the section of the study addressed in this paper

The study sought to investigate how CDC influences knowledge sharing behaviour and IB directly, and how CDC indirectly, via the mediating influence of knowledge sharing behaviour, impact on technology students' innovative behaviour. More precisely, the purpose of the section of the study reported on in this paper was to test a model, which hypothesized that CDC is positively related to KSB among undergraduate technology students in Kenya. In turn, KSB and CDC are positively related to IB, with KSB acting as a mediator variable in the relationship between these individual and contextual antecedents of innovative behaviour.

If universities continue to offer courses that are defective in their design and ignore the individual and contextual antecedents, such as CDC, then the goal of producing graduates, who can transform resources into products, processes and services will continue being a mirage. Further, it is not clear how KSB may affect the endogenous outcome of IB. Therefore, identifying the antecedents of technology students' IB in university education is critical.

By identifying the individual and contextual factors that trigger knowledge sharing, and eventually lead to higher levels of IB, the study should pave the way for aligning course design to support innovative behaviour in students. Furthermore, it is envisaged that the identification of additional individual and contextual antecedents should provide universities with empirical knowledge and practical answers in their quest to inculcate and nurture

innovative tendencies in students. This may entail offering suitable and appropriate programmes and environmental setting.

Based on the stated problem and purpose, the part of this study reported on in this paper sought to answer the following research questions:

1) What are the psychometric properties of the proposed course design characteristics scale in the context of university education, and to what extent is it a valid and reliable measure?

To what extent is there a relationship between course design characteristics and:

2) the endogenous variable of innovative behaviour?

3) students' knowledge sharing behaviour?

and

4) How does knowledge sharing behaviour mediate the relationship between course design characteristics and the endogenous variable of innovative behaviour?

1.4   Review of the literature

The concept of job design has been well researched in literature. An understanding of the Job Characteristics Model (JCM) would require an initial investigation of the concept of job design. What is job design? Job design is defined as "the actual structure of jobs that employees perform" (Oldham, 2012, p. 652). According to Foss, Minbaeva, Pedersen and Reinholt (2009, p. 873), job design refers to identifying "the relevant tasks and activities and allocating them across employees in a way that allows the organization to reap benefits from specialization, as well as bundling job tasks to take into account possible synergies between tasks."

The Job Characteristics Model has been widely used to measure job design. However, critics of the JCM model question the psychometric properties of the Job Diagnostic Survey (JDS). Specifically, Taber and Taylor (1990) questioned the low internal consistency of the scale. To address the low internal consistency, Campion and Thayer (1985) developed the Multimethod Job Design Questionnaire (MJDQ). The new scale had more constructs that measured job characteristics. However, it too did not get wide acceptance due to gaps in measurement, as well as inherent deficiencies in elucidating the autonomy construct, which is a critical work characteristics construct (Medsker & Campion, 1997).

Recent studies that have examined the concept of *knowledge sharing behaviour* include Akturan and Çekmecelioğlu (2016), Chumg, Seaton, Cooke and Ding (2016), Roth (2016), Tjoflåt, Razaonandrianina, Karlsen and Hansen (2017), Wen and Qiang (2016) and Yilmaz (2016).

Literature conducted in developing countries has explored several determinants of IB (Jilcha, Kitaw, & Beshah, 2016). The concept of idea generation in the *innovative behaviour* process has been widely researched. Studies by e.g. Herrmann, Binz, and Roth (2016) convey the message that the process of idea generation requires one to have knowledge about a need or a problem. According to De Jong and Den Hartog (2010, p. 24), idea generation encompasses "the entry of new markets, improvements in current work processes, or in general terms, solutions to identified problems". Idea generation also involves the "combination and reorganization of information and existing concepts to solve problems or to improve performance" (De Jong & Den Hartog, 2010, p. 7). In the context of the present study, idea generation is operationalised to refer to the cognitive permutations involved in seeking out novel answers and solutions to ill-structured technological problems. There is a lot of further literature on the concept of idea generation, including e.g. Li and Hsu (2016).

The idea implementation stage in the *innovative behaviour* process requires "considerable effort and a result-oriented attitude are needed to make ideas happen" (De Jong & Den Hartog, 2010, p. 24). More recent studies on the idea implementation stage of innovation have been conducted by Aleksić, Škerlavaj and Dysvik (2016), Buch and Kuvaas (2016) and Trošt and Škerlavaj (2016), in the setting of innovation.

Previously, the Kleysen and Street (2001) scale has been used extensively in IB research, for example by Alghadeer and Mohamed (2016), Li and Hsu (2017) and Sethibe and Steyn (2017).

2. Conceptual framework

2.1 Task characteristics

Task characteristics are defined by Morgeson and Humphrey (2006, p. 1323) as "how the work itself is accomplished and the range and nature of tasks associated with a particular job". The task characteristics has five (5) dimensions, namely autonomy, task significance, feedback from job, task identity and task variety. The first three of these are discussed in

more detail in the following paragraphs, while more on the last two can be found in Ngugi and Goosen (2018).

The concept of *autonomy* has evolved from the initial narrow concept of the degree of freedom and independence (Hackman & Oldham, 1980), to now reflect "the extent to which a job allows freedom, independence, and discretion to schedule work, make decisions, and choose the methods used to perform tasks" (Morgeson & Humphrey, 2006, p. 1323).

Task significance, according to Morgeson and Humphrey (2006, p. 1323) is "the degree to which the job has a substantial impact on the lives or work of other people whether in the immediate organization or in the external environment". Similarly, Burke (1990, p. 23) defines task significance as the "degree to which the job has a substantial impact on the lives or work of other people whether in the immediate organization or in the external environment".

Feedback from job, according to Morgeson and Humphrey (2006, p. 1323), is defined as "the degree to which carrying out the work activities required by the job results in the employees obtaining information about the effectiveness of their performance". Similarly, feedback from the job, according to Burke (1990, p. 24), is "the degree to which carrying out the work activities required by the job results in the employees obtaining information about the effectiveness of their performance".

2.2   Knowledge Characteristics

Knowledge characteristics are defined as "the kinds of knowledge, skill, and ability demands that are placed on an individual as a function of what is done on the job" (Morgeson & Humphrey, 2006, p. 1323). The knowledge characteristics are further grouped into five domains namely: "job complexity, information processing, problem solving, skill variety and" specialisation (*Ibid.*). The five (5) domains of knowledge characteristics are discussed in more detail in the following:

1) *Job complexity* was defined by Morgeson and Humphrey (2006, p. 1323) as "the extent to which the tasks on a job are complex and difficult to perform".

2) According to Morgeson and Humphrey (2006, p. 1323), *information processing* "reflects the degree to which a job requires attending to and processing data or other information".

3) *Problem solving*, according to Morgeson and Humphrey (2006, p. 1323), is defined as "the degree to which a job requires unique ideas or solutions and reflects the more active cognitive processing requirements of a job".

4) *Skill variety*, according to Burke (1990, p. 38), is "the degree to which a job requires a variety of different activities in carrying out the work, which involves the use of a number of different skills and talents of the employee". However, skill variety has been operationalized in this study to reflects the array or multifariousness of skill sets a student requires to accomplish a technological project.

5) *Specialisation* is defined by Morgeson and Humphrey (2006, p. 1323) as "the extent to which a job involves performing specialized tasks or possessing specialized knowledge and skill".

The interplay between the adjusted variables, as implemented in this study, is provided in Figure 1.
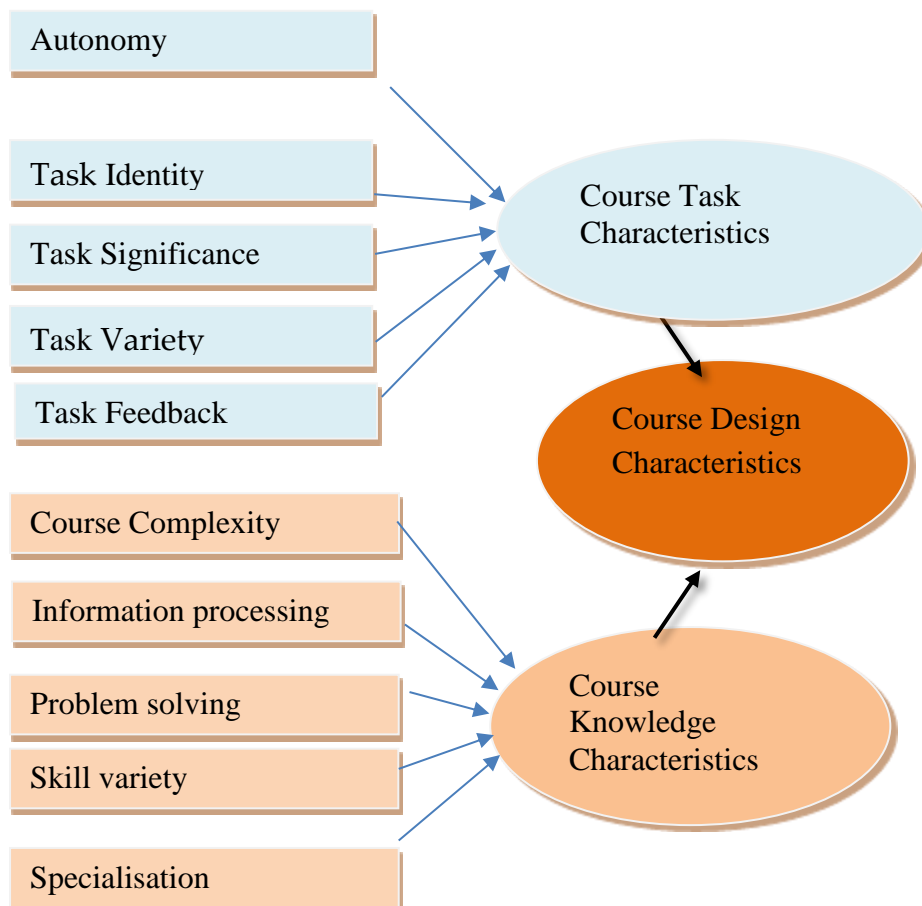

Figure 1: Conceptual Framework

3. Methods/Techniques

With regard to the research design, Ngugi and Goosen (2018, p. 6) indicated that in "a cross-sectional study, a quantitative, non-experimental research design was chosen". In terms of the data collection instruments, the "measurement of the latent exogenous and endogenous variables made use of a set of quantitative self-report measures." Seven public Kenyan "universities (21%) were selected at random as the target population"; thereafter, "a representative selection of these universities was made, using stratified random sampling techniques" (Ngugi & Goosen, 2018, p. 7). Finally, to "ensure construct validity, the measurement items were sourced and adapted from previous validated multi-disciplinary measures".

A **reliability** analysis of the merged CDC scale generated a Cronbach alpha value of 0.881 for the thirty items in the scale. Thereafter, Principal Component Analysis with Varimax Rotation was conducted on the thirty CDC items to determine the internal structure of the CDC construct. Firstly, an examination of the Kaiser-Meyer-Olkin (KMO) measure of **sampling** adequacy provided an indication of whether the sample size was sufficient to proceed with the extraction and that the characteristics of the data set are appropriate for Exploratory Factor Analysis (EFA). The KMO index ranges can be interpreted using the "following guidelines: 0.90 or above," marvellous; "0.80 or above, meritorious; 0.70 or above, middling; 0.60 or above, mediocre; 0.50 or above, miserable; and below 0.50, unacceptable" (Hair Jr, Anderson, Tatham, & Black, 1995, p. 374). Similar sentiments can be found in the more recent edition by Hair, Anderson, Babin and Black (2010). The items met the conditions for tests of factor analysis, since the Kaiser–Meyer–Olkin score of 0.93 was 'marvellous'.

3.1   Instrument for the Measurement of Innovative Behaviour (IB)

The measure of innovative behaviour was based on the scale by Hartjes (2010). The scale has eleven items that measure the four (4) sub-constructs of opportunity exploration, idea generation, championing and application.

3.2 Bootstrapping

Based on the literature review, the mediation analysis diverges from the approach used by Baron and Kenny (1986). The bootstrapping method has been applied by multiple authors to test mediation in the field of knowledge sharing (Rahman, Osmangani, Daud, Chowdhury, & Hassan, 2015) and studies related to innovative behaviour (Hakimian, et al., 2016;

Molodchik, et al., 2016). Lee (2016) applied bootstrapping in a study involving both KSB and IB.

3.3 Data Analysis Techniques

The preliminary stages of data analysis involved diagnosis and correcting for problems of missing data, outliers, multi-collinearity and violations of statistical assumptions before applying statistical procedures (Hair, 2015; Jauhar, Ghani, & Islam, 2016).

4. Results/findings

To answer the first research question set, the first step in checking the accuracy of the input involved an exploration of the range values (minimum and maximum values), as well as an examination of whether the means and standard deviations were plausible (Jauhar, et al., 2016).

After a series of extractions and elimination of factors with low communalities, the rotated component factor matrix that resulted was as presented in Table 1.

All items of the course design characteristics scale had factor loadings well above the threshold cut-off point of 0.35, as suggested by Hair Jr, Anderson, Tatham and Black (1998). Scrutiny of the five (5) items on which the first factor loaded suggested that the dominant theme had a relationship with skill variety. Thus, Factor 1 was fittingly branded *skill variety* and accounted for 16.123 per cent of the variance in course design characteristics. Further, skill variety had an Eigen value of 4.568 and internal consistency reliability Cronbach alpha value of 0.735.

All three (3) items on which the second factor loaded appeared to be referring to course complexity and hence Factor 2 was duly labelled *course complexity*. The course complexity had good internal consistency reliability as the Cronbach alpha of 0.668 was good. Further, the factor accounted for 15.347% of the variance in course design characteristics. In addition, the Eigen value of 2.001 was well above the recommended Kaiser Criterion of 1.0.

Factor 3 appeared to be referring to scheduling autonomy and was thus duly labelled *scheduling autonomy*. It had good psychometric properties, with a Cronbach alpha of 0.759, accounting for 13.854 % of the variance in course design characteristics and an Eigen value of 1.322.

Lastly, Factor 4 had four (4) items that had a dominant theme of technology feedback and was thus duly labelled *technology feedback*. This factor had a Cronbach alpha of 0.683, accounted for 11.352 % of the variance in course design characteristics and an Eigen value of 1.177.

The study then proceeded to develop a measurement model by constraining the four (4) items to the skill variety subscale of course design characteristics, three (3) to course complexity, four (4) to scheduling autonomy and four (4) items to the technology feedback subscale. First, even though a general assumption was made that error terms are generally independent of one

Table 1: Principal Component Analysis Matrix after Varimax Rotation with Kaiser Normalization for Course Design Characteristics Scale

	Skill Variety	*Course Complexity*	*Scheduling Autonomy*	*Technology Feedback*
KC_SVA1_25	.786			
KC_SVA2_26	.737			
KC_PRO3_24	.640			
KC_SVA3_27	.628			
KC_PRO2_23	.541			
KC_COM4_21		.775		
KC_COM3_20		.748		
KC_COM2_19		.571		
TC_MEA1_4			.769	
TC_DMA1_3			.743	
TC_SCA2_2			.723	
TC_SCA1_1			.690	
TC_TFB3_17				.760
TC_TFB2_16				.718
TC_TID2_13				.638
TC_TSI2_11				.607
No. of Items	5	3	4	4

Cronbach Alpha	0.735	0.668.	0.759	0.683
Eigen Value	4.568	2.001	1.322	1.177
% of Variance	16.123	15.347	13.854	11.352

another, there is still the likelihood of correlated errors being in place for items that are close on the questionnaire, or items having analogous wording, thus hindering respondents' ability to distinguish them (Bollen & Lennox, 1991). Hence, based on theoretical suggestions and values of the error modification indices that implied covariation, such error terms were made to covary. The measurement model generated for the course design characteristics scale was as presented in Figure 2.

The fit indices for the measurement model of the course design characteristics scale is summarized in Table 2.

With regard to the normed Chi-square ($\chi2$) value, the measurement model for the course design characteristics construct did not produce an acceptable fit, as the $\chi2$ statistic was significant ($\chi2$ =124.030, df=84, p<0.05), suggesting that the measurement model did not sufficiently explain the observed covariation among the variables (Hair et al., 1998).

However, all the other fit indices of Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI) and Normed Fit Index (NFI) yielded evidence of good fit, as the values were all above the cut-off criterion suggested by Hair et al. (1998) of 0.90.

The Root Mean Square Error of Approximation (RMSEA) and Root Mean Square Residual (RMR) values were less than the recommended cut-off values of 0.08 and 0.10 respectively, as suggested by Kline (2005). Further, the factor loadings' t-values were all significant. In addition, all reliability and variance extracted measures surpassed the recommended levels of 0.5 (Bagozzi, Yi, & Nassen, 1998; Fornell & Larcker, 1981; Hair et al., 1998). The correlation between course complexity and technology feedback, in terms of statistical significance and

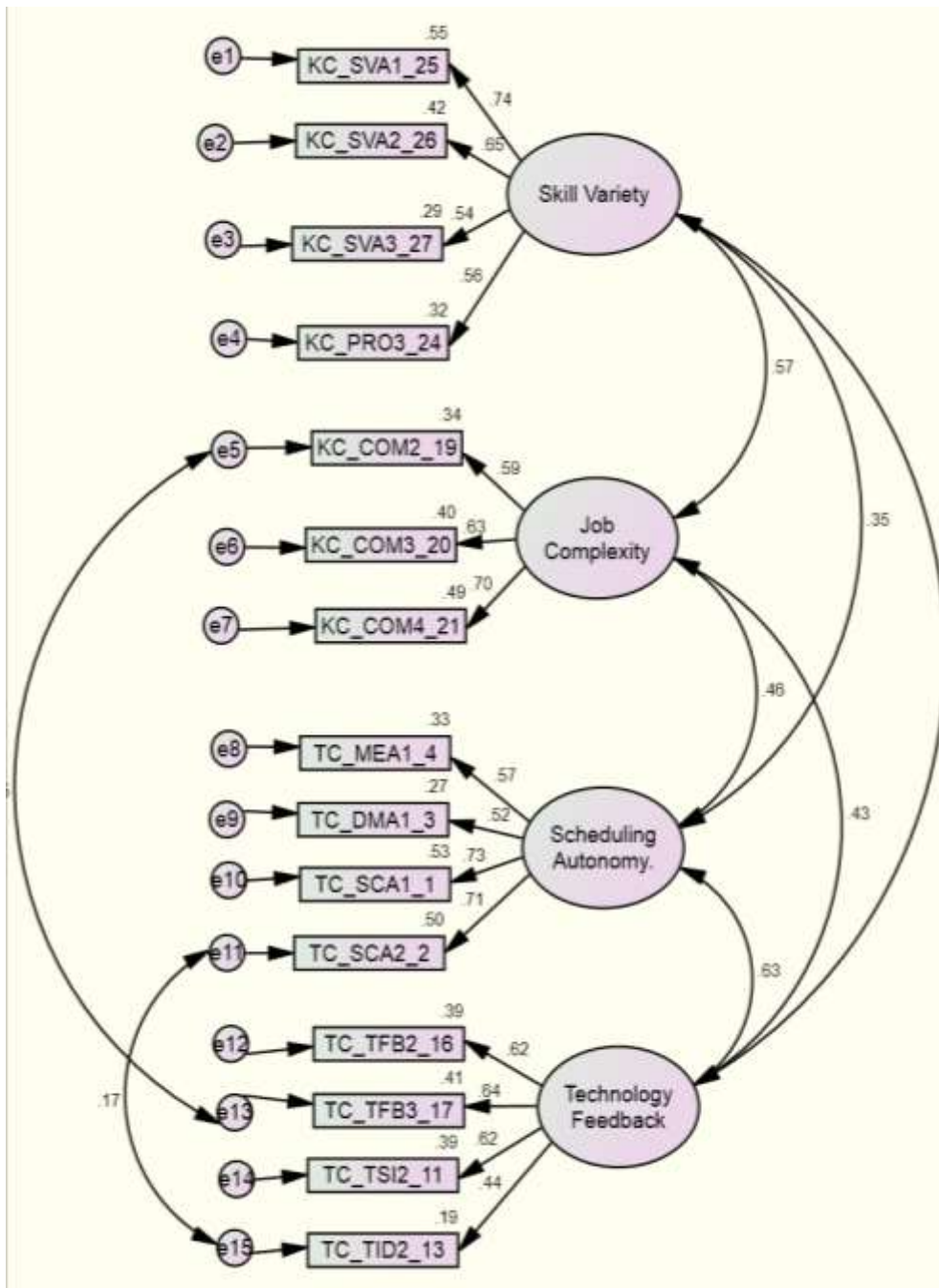**Figure 2: Measurement model for course design characteristics scale factor solution**

magnitude, provided evidence to support the distinctiveness of the two factors, although they are positively correlated dimensions of course design characteristics.

4.1   Estimation of the indirect effects

Baron and Kenny (1986) proposed the causal steps approach for testing hypotheses involving intervening variables.

5. Discussion of Findings, Conclusion and Recommendations

Answering the second research question set for this paper, the study revealed that CDC has a significant positive indirect effect on innovative behaviour. The study thus contributes and adds to KSB and innovative behaviour literature by having examined the mediating mechanisms through which CDC ultimately influences innovative behaviour.

Table 2: Measurement Model and Fit Indices for 4-Factor Solution Of Course Design Characteristics Scale

Fit Index	Value
Chi-Square Value	124.030
Degrees of Freedom (DF)	84
p value	0.003
CMIN/DF	1.325
GFI*	.944
AGFI*	.918
RMR*	.030
TLI*	.956
CFI*	.965
NFI*	.876
RMSEA*	0.037

The present study has generated empirical evidence that band course design characteristics at the contextual and individual level and shows how this driver impacts on technology students' knowledge sharing and innovative behaviour. The findings revealed that there was a direct relationship between CDC and innovative behaviour. In addition, the interaction of CDC on innovative behaviour performance was fully mediated by KSB. Overall, results confirmed what is already known from the findings of Martín, Potočnik and Fras (2015) that students who share knowledge with their colleagues reciprocate with higher levels of innovative behaviour.

Additional information, providing further indications of the depth of research that went into this study, can be found in Ngugi and Goosen (2017, 2018).

Specifically, this study makes a contribution to the field theoretically in three (3) ways. Firstly, the research sought to validate the Course Design Characteristics (CDC) construct as a significant antecedent and a good driver of IB, by investigating relationships surrounding CDC. The results of this linkage should be useful in improving course design in university education, and ultimately contribute to the accelerated education and training of a critical mass of innovative future workers.

By answering the third research question set for this paper, with CDC an antecedent of knowledge sharing behaviour in the setting of university education, the study bridged the knowledge gap on research that model the mediating influence of KSB on the IB. The study should address the paucity of models in the context of university education that explore the mediating role of KSB on the path linking the exogenous variable of CDC to the endogenous variable of IB. As the hypothesized relationships were indeed significant, the study contributes to the scant literature of significant antecedents of IB that are mediated by KSB, in the context of undergraduate technology students.

Lastly, in answer to the final research question set for this paper, the main finding of the present study was that KSB fully mediated the effect of CDC on IB.

In conclusion, this subsection has now presented a succinct discussion and summary of the major findings in the context of IT students in university education, as well as expounding on the contributions of the study. The following subsection proceeds to illustrate some of the applicable resultant recommendations for future study.

5.1   Recommendations for Further Research

One useful extension would be to explore and incorporate extencis theory (Yang, Zhang, & Cai, 2002). Extencis deals with contradictory problems, while considering each matter as having four extensibilities: the divergent nature, the conjugate nature, the correlative nature, and the implicative nature. Other suggestions include previous innovation behaviours as suggested by Martín, et al. (2015).

The study also provides a foundation for extended research on other significant antecedents at individual and contextual level, which, if leveraged, can contribute to producing knowledge workers with innovative behaviour. Such a critical mass of students with innovative tendencies would be champions in the "production of novel and useful ideas or solutions

concerning products, services, processes, and procedures" (Rego, Sousa, Marques, & e Cunha, 2012, p. 429).

6. References

Akturan, A., & Çekmecelioğlu, H. G. (2016). The effects of knowledge sharing and organizational citizenship behaviors on creative behaviors in educational institutions. *Procedia - Social and Behavioral Sciences, 235*, 342 - 350. doi:10.1016/j.sbspro.2016.11

Aleksić, D., Škerlavaj, M., & Dysvik, A. (2016). The flow of creativity for idea implementation. In *Capitalizing on Creativity at Work: Fostering the Implementation of creative ideas in organizations* (pp. 29 - 38). Cheltenham, UK: Edward Elgar Publishing.

Alghadeer, A., & Mohamed, S. (2016). Diffusion of organisational innovation in Saudi Arabia: The case of the Project Management Office (PMO). *International Journal of Innovation and Technology Management, 13*(4), 1 - 22. doi:10.1142/S021987701650019X

Bagozzi, R. P., Yi, Y., & Nassen, K. D. (1998). Representation of measurement error in marketing variables: Review of approaches and extension to three-facet designs. *Journal of Econometrics, 89*(1), 393 - 421.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173 - 1182.

Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin, 110*(2), 305 - 314.

Buch, R., & Kuvaas, B. (2016). Economic and social leader–member exchange, and creativity at work. In *Capitalizing on creativity at work: Fostering the Implementation of Creative Ideas in Organizations* (pp. 114 - 125). Cheltenham, UK: Edward Elgar Publishing.

Burke, C. J. (1990). *The Strategic Air Command Readiness Oriented Logistics System (ROLS): A Comparison of the Work Attitudes of Aircraft Maintenance Specialists (No. AFIT/GLM/LSM/90S-8).* Wright-Patterson Air Force Base, OH: Air Force Institute of Technology.

Campion, M. A., & Thayer, P. W. (1985). Development and field evaluation of an interdisciplinary measure of job design. *Journal of Applied Psychology, 70*(1), 29-43.

Chumg, H. F., Seaton, J., Cooke, L., & Ding, W. Y. (2016). Factors affecting employees' knowledge-sharing behaviour in the virtual organisation from the perspectives of well-being and organisational behaviour. *Computers in Human Behavior, 64*, 432 - 448. doi:10.1016/j.chb.2016.07.011

De Jong, J. P., & Den Hartog, D. N. (2010). Measuring innovative work behaviour. *Creativity and Innovation Management, 19*(1), 23 - 36.

Fornell, C., & Larcker, D. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 382-388.

Foss, N. J., Minbaeva, D. B., Pedersen, T., & Reinholt, M. (2009). Encouraging knowledge sharing among employees: How job design matters. *Human Resource Management, 48*(6), 871 - 893.

Hackman, J. R., & Oldham, G. R. (1980). *Work redesign.* Reading, MA: Addison-Wesley.

Hair Jr, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). *Multivariate data analysis with readings.* New Jersey, NJ: Prentice Hall.

Hair Jr, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). New Jersey, NJ: Prentice-Hall.

Hair, J. F. (2015). *Essentials of business research methods.* ME: Sharpe.

Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). *Multivariate data analysis: A global perspective* (Vol. 7). Upper Saddle River: Pearson.

Hakimian, F., Farid, H., Ismail, M. N., & Nair, P. K. (2016). Importance of commitment in encouraging employees' innovative behaviour. *Asia-Pacific Journal of Business Administration, 8*(1), 70 - 83.

Hartjes, B. J. (2010). *Aligning employee competences with organizational innovation strategy: A case study at B.V. Twentsche Kabelfabriek.* (Unpublished Master's Thesis). Enschede, The Netherlands: University of Twente. Retrieved March 14, 2015, from http://essay.utwente.nl/59930/1/MA_thesis_B_Hartjes.pdf

Herrmann, T., Binz, H., & Roth, D. (2016). Approach for creating a refined task as preparation for a target-oriented idea generation process. In *Proceedings of the 14th International DESIGN Conference* (pp. 1035-1044). Dubrovnik: The Design Society.

Iacobucci, D., Saldanha, N., & Deng, X. (2007). A meditation on mediation: Evidence that structural equation models perform better than regressions. *Journal of Consumer Psychology, 17*, 139 - 153.

Jauhar, J. B., Ghani, A. B., & Islam, R. (2016). Results and data analysis. In *Brain Drain* (pp. 127 - 158). Singapore: Springer.

Jilcha, K., Kitaw, D., & Beshah, B. (2016). Workplace innovation influence on occupational safety and health. *African Journal of Science, Technology, Innovation and Development, 8*(1), 33 - 42.

Kleysen, R. F., & Street, C. T. (2001). Toward a multi-dimensional measure of individual innovative behavior. *Journal of Intellectual Capital, 2*(3), 284 - 296.

Kline, R. (2005). *Principles and practice of structural equation modeling.* New York: Guilford Press.

Lee, K. J. (2016). Sense of calling and career satisfaction of hotel frontline employees: Mediation through knowledge sharing behaviour with organizational members. *International Journal of Contemporary Hospitality Management, 28*(2), 346-365.

Li, M. & Hsu, C. (2017). Customer participation in services and its effect on employee innovative behavior. *Journal of Hospitality Marketing & Management, 26*(2), 164-185.

Li, M., & Hsu, C. H. (2016). A review of employee innovative behavior in services. *International Journal of Contemporary Hospitality Management, 28*(12), 2820-2841.

Martín, P., Potočnik, K., & Fras, A. B. (2015). Determinants of students' innovation in higher education. *Studies in Higher Education, 42*(7), 1229 - 1243.

Medsker, G. J., & Campion, M. A. (1997). Job and team design. In *Handbook of Industrial Engineering: Technology and Operations Management*. New York: John Wiley.

Molodchik, M., Krutova, A., & Molodchik, A. (2016). Leadership, learning and organisational culture as antecedents for innovative behaviour: the case of Russia. *International Journal of Learning and Intellectual Capital, 13*(2-3), 202-215.

Morgeson, F. P., & Humphrey, S. E. (2006). The Work Design Questionnaire (WDQ): Developing and validating a comprehensive measure for assessing course design and the nature of work. *Journal of Applied Psychology, 91*(6), 1321–1339.

Ngugi, J., & Goosen, L. (2017). The Effects of Course Design Characteristics, Self-Regulated Learning and Knowledge Sharing in Facilitating the Development of Innovative Behaviour among Technology Students at Universities. *Proceedings of the Institute of*

Science and Technology Education (ISTE) (pp. 80-86). Mopani Camp, Kruger National Park: UNISA.

Ngugi, J., & Goosen, L. (2018). Modelling Course-Design Characteristics, Self-Regulated Learning and the Mediating Effect of Knowledge-Sharing Behavior as Drivers of Individual Innovative Behavior. *EURASIA Journal of Mathematics, Science and Technology Education, 14*(8). doi:https://doi.org/10.29333/ejmste/92087

Oldham, G. R. (2012). The design of jobs: A strategy for enhancing the positive outcomes of individuals at work. In G. M. Spreitzer, & K. S. Cameron (Eds.), *The Oxford Handbook of Positive Organizational Scholarship* (pp. 651 - 663). Oxford: Oxford University Press. doi:10.1093/oxfordhb/9780199734610.013.0049

Rahman, M., Osmangani, A., Daud, N., Chowdhury, A., & Hassan, H. (2015). Trust and work place spirituality on knowledge sharing behaviour: Perspective from non-academic staff of higher learning institutions. *The Learning Organization, 22*(6), 317-332.

Rego, A., Sousa, F., Marques, C., & eCunha, M. (2012). Authentic leadership promoting employees' psychological capital and creativity. *Journal of Business Research, 65*(3), 429-437.

Roth, A. E. (2016). *Knowledge sharing behaviour intentions in wholesale distribution organizations.* (Unpublished Doctoral Dissertation) Walden University, Minneapolis.

Sethibe, T., & Steyn, R. (2017, February). The impact of leadership styles and the components of leadership styles on innovative behaviour. *International Journal of Innovation Management, 21*(2), 1 - 19. doi:10.1142/S1363919617500153

Taber, T. D., & Taylor, E. (1990). A review and evaluation of the psychometric properties of the Job Diagnostic Survey. *Personnel Psychology, 43*(3), 467 - 500.

Tjoflåt, I., Razaonandrianina, J., Karlsen, B., & Hansen, B. S. (2017). Complementary knowledge sharing: Experiences of nursing students participating in an educational exchange program between Madagascar and Norway. *Nurse Education Today, 49*, 33 - 38. doi:10.1016/j.nedt.2016.11.011

Trošt, J. K., & Škerlavaj, M. (2016). Should our heart rule our head? Team innovation through intuition and rationality. In *Capitalizing on Creativity at Work: Fostering the Implementation of Creative Ideas in Organizations* (pp. 64 - 75). Cheltenham, UK: Edward Elgar Publishing.

Tuomi, J., Aimala, A. M., Plazar, N., Starčič, A. I., & Žvanut, B. (2013). Students' well-being in nursing undergraduate education. *Nurse education today, 33*(6), 692 - 697.

Wen, Q., & Qiang, M. (2016). Coordination and knowledge sharing in construction project-based organization: A longitudinal structural equation model analysis. *Automation in Construction, 72*(3), 309 - 320. doi:10.1016/j.autcon.2016.06.002

Yang, C. Y., Zhang, Y. J., & Cai, W. (2002). Study on extension set and its applications. *Mathematics in Practice and Theory, 32*(2), 301 - 308.

Yilmaz, R. (2016). Knowledge sharing behaviours in e-learning community: Exploring the role of academic self-efficacy and sense of community. *Computers in Human Behavior, 63*, 373 - 382. doi:10.1016/j.chb.2016.05.055

A GUIDE TO ONLINE ASSESSMENT IN LARGE ENGINEERING DESIGN CLASSROOMS

Muaaz Bhamjee[1] & Naiefa Rashied[2]

[1] Department of Mechanical Engineering Science, University of Johannesburg, Johannesburg, South Africa, muaazb@uj.ac.za

[2] School of Economics, University of Johannesburg, Johannesburg, South Africa, naiefar@uj.ac.za

Abstract

Student protests in 2015 and 2016 along with the inherent colonial nature of African universities has sparked reflective conversation among university academics in the areas of curriculum development and teaching practice in South Africa. Consequently, the online classroom, though typically perceived as pedagogically unconventional at residential universities in South Africa, is increasingly seen as an innovative way to encourage educator and student engagement with discipline-specific content. In addition, online assessment at residential universities in South Africa is growing in popularity due to its time-saving and efficiency properties. However, there is very little guidance available to educators who wish to conduct online assessments in large classrooms. The purpose of this study is to provide a guide to educators on how to execute online assessment in large classrooms, with specific application to engineering design. The study begins by outlining why an educator may want to consider online assessment for a large classroom. Thereafter, the study explores face-to-face assessment theory vis-à-vis online assessment theory with respect to purpose and efficiency. Following this, the study characterizes the nature of the engineering design classroom used in this study. Subsequently, the study explains the merits and drawbacks of online assessment and provides practical recommendations on how to overcome potential and typical challenges faced in a large engineering design classroom. Findings may prove valuable to other teaching environments and disciplines interested in effective online assessment for large classrooms.

1. Introduction

While assessment is primarily used to gauge student learning, it is also used to improve curricula and reflectively enhance the teaching and learning process (Gaytan and McEwen, 2007). Assessment is traditionally defined as "the wide variety of methods or tools that

educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students" (Great Schools Partnership, 2015). Similarly, online assessment "involves translating the unique benefits of face-to-face interaction to online activities" (Gaytan and McEwen, 2007).

However, this "translation" is sometimes misinterpreted when online assessment is confused with computer-graded tests or multiple choice-type questions. In this study, we assert that online assessment is not the same as computer-graded tests. Rather, it is a combination of computer-graded, and sometimes layered multiple-choice questions, with discussion or essay-style questions, which gives educators more freedom to diversify assessment methods, even in large classrooms. The reason we make this distinction is that the size of the classroom sometimes influences the kinds of teaching and assessment methods employed in a teaching strategy. For example, as class size increases, methods of assessment shift from expensive, conventional approaches, such as essay-writing, to more cost-effective and efficient methods, such as computer-graded testing or multiple-choice questions (Paré and Joordens, 2008). With this in mind, there is very little objective information available to guide educators on when, why and how to make use of online assessment in a large classroom.

Thus, the aim of this study is to contribute to the sparse research on online assessment for South African students by examining, in detail, the application of online assessment in a large classroom. The objective of the study is to provide a guide to educators on how to execute online assessment in large classrooms, with specific application to engineering design, so that they may realise the benefits and drawbacks of online assessment in the South African context. This study hypothesises that online assessment, in a large classroom, reduces grading timelines and thus, provides educators with an opportunity to provide feedback that is more detailed to students.

2. Conceptual framework

2.1. Assessment Theory

Assessment theory has evolved over time. Between 1900 and 1980, the dominant paradigm of learning theory and learning measurement was deeply rooted in the interaction between social efficiency curriculum, hereditation theory of the intelligence quotient (IQ), associationist and behaviourist learning. Learning during this time was viewed as granular, and accompanied by objective tests to measure achievement (Shepard, 2000). By the 1980s,

new views of learning and instruction emerged, while the traditional measurement of learning remained, creating a disjoint between instruction and learning measurement. From 1990 onwards, the paradigm of learning theory was rooted in cognitive and constructivist frameworks and accompanied by a diversity of learning measurement strategies.

Despite the drastic theoretical shift in teaching and learning practice, most residential universities in South Africa make use of the neo-behaviourist model of mastery learning. This model was developed by Bloom, Hasting and Madaus (1971) who purport that an effective learning strategy comprises of small units of learning followed by formative assessment. While this model appears to be a balanced combination of Shepard's old and emerging paradigms of learning and measurement, the neo-behaviourist education framework, as applied in the South African context, appears to be prioritising student throughput rates without always considering student enrichment. The lack of longitudinal data on students, as highlighted by Sondlo (2013), does not allow us to investigate this which exacerbates the focus on student throughput rates and seems to encourage a symptomatic approach to learning measurement as opposed to a systematic approach.

2.2. The History of e-pedagogy

The origins of e-assessment can be traced back to 1975 in the United States. Hench (2014) outlines three stages of evolving e-pedagogy prevalent in the United States between 1975 and 2012. Stage 1, characterised by computer-assisted instruction and measurement between 1975 and 1990, was primarily behaviourist meaning that learning measurement typically focused on objectively observable behaviors and disregarded any independent activities of the mind. Stage 2, characterised by an increase in computer-based instruction together with computer-assisted instruction, between 1990 and 2000, was a combination of behaviourist and constructivist learning paradigms. Stage 3, though still characterised as a combination of behaviourist and constructivist learning paradigms from 2000 to 2012, is more constructivist than behaviourist in nature. This could be attributed to the increased use of educational technologies and the fact that educational technologies support constructivist e-learning and e-assessment platforms. Though Hench (2014) specified these stages for the United States, they were very much a mirror of the global transition from behaviourist to constructivist approaches to teaching and learning.

It appears as though online assessment presents educators with an opportunity to balance automated-grading style questions with engagement questions, in a more constructivist

setting. It also provides students with an opportunity to familiarise themselves with the technology accompanying the assessment, which is important in the South African context where university students are not as proficient with technology or computer literacy (Hlalele, 2016).

3. Methodology

This study makes use of a descriptive research design in the form of a case study. The study analyses the structure of a first year engineering design course offered to the 2018 cohort of students from a large residential university in the Gauteng province. Because of the nature of the research design, no data collection instrument or sampling technique was used. Instead, the course and how online assessment was applied within it was examined up-close and in-depth, which is in line with a case study approach (Yin, 2011). The module used in this research is a first year, first semester module, which serves as an introduction to engineering as well as an introduction to engineering design. The class is a foundation module in the mechanical, electrical, electrical with IT and civil engineering science programs. The nominal class size is 390 students but ranges between 360 and 420 students. The mode of instruction is face to face, divided into a one and a half hour lecture per week, three tutorials, two workshops and one practical per semester, all of which are compulsory.

The tutorials, workshops and practical are three hours and fifteen minute sessions. In addition to the formal contact time, the students have access to the lecturer and co-lecturer via three hours of consultations per week as well as voluntary contact with the tutors during the tutorial timeslot on weeks that do not have a formal tutorial, workshop or practical. On a whole the typical first year engineering student at the University spends between five and ten hours per day in lectures, tutorials and practicals during weekdays. This, together with independent learning, forms an 8 credit module, which is equivalent to 80 notional hours for the semester. In the South African context, 1 credit is equivalent to 10 notional hours. Notional hours of learning are defined as "learning time that it would take an average learner to meet the outcomes defined. It includes concepts such as contact time, time spent in structured learning in the workplace, individual learning and assessment." (South African Qualifications Authority, 2000, p. 12).

The students are provided with a learner guide upon commencement of the module in addition to weekly lecture slides, tutorial content and supplementary material. The learner guide provides an overview of the course content, course structure, the module requirements, student role and responsibilities, a module semester schedule, overview of the assessments and recommended reading material. All material is made available to students on the learning management system, Blackboard.

Assessments follow the typical neo-behaviourist approach and comprise of two semester tests, two assignments, a practical, three tutorial tests and an examination. The first assignment is a group-based video project and the second assignment is an individual engineering design project. The practical is a group-based engineering design task. The tutorial tests are thirty-minute tests based on the content covered in the corresponding tutorial. The semester tests are one and a half hour assessments that have elements of theory and engineering analysis commonly used in engineering design tasks. The semester tests, assignments, practicals and tutorial tests constitute a semester mark. The examination is a three-hour assessment in the same vain as the semester tests. The semester mark and the examination mark are weighted equally towards a final grade for the module.

Originally, the assessments were paper-based submissions apart from the video assignment. The video assignment is submitted on a DVD or shared via the students' choice of cloud-based storage systems. The practical has remained a paper-based assessment, where the students submit a group report on the assigned design task along with a tested design prototype by the end of the session. The tutorial tests were administered as a closed book, paper based test, prior to the end of the tutorial session. The semester tests and the examination were administered as closed book paper-based tests.

Due to the large class size, paper-based assessments, particularly the tutorial tests, semester tests and the examination required significant time to grade. The large grading timelines typically delay student feedback and influences time available to spend on other meaningful teaching and learning interventions and research.

As a result of the volume and frequency of assessment here, initial attempts were made to administer the tutorial tests using Blackboard. Whilst this worked for the simple tutorial tests that contained basic theory, analysis and calculation-based questions, significant thought was given to how one could use the online approach for more complex assessment whilst still

being able to assess the method employed by the student. To overcome this, a past semester test was replicated in Blackboard and tested by the lecturer. In addition, another lecturer assisted in testing the approach by taking the mock test from the perspective of a student and provided critical feedback. The university provided assistance by ensuring that appropriate infrastructure was provided in the form of sufficiently sized and equipped computer laboratories. The academic technologies division provided institutional support concerning set up of specific question types, security of the assessments, moderation processes and evidence collection for quality review. The study satisfied the ethical clearance requirements of the residential university.

4. Data Analysis, Findings and Discussions

In this context, migrating from a paper-based assessment to an online assessment provided a variety of challenges. The primary challenge was to maintain the macro-structure of the assessment, thus, maintaining the quality of the assessment. Secondary challenges, yet vital to the success of the approach, were to ensure appropriate mechanisms for moderation, evidence collection for compulsory module evidence files, assessment security as well as mitigating and managing unforeseen technical glitches.

4.1. Maintaining the Assessment Structure and Quality

To overcome the challenge of preserving the macro-structure of the assessment, questions were fragmented in to smaller questions that either lead into the next question or act as a follow- up to the previous question. Source: Authors' own presents an example of how a question from the original paper-based assessment was fragmented into smaller questions for the online assessment.

From Source: Authors' own, in the online version of the question, Q.1, Q.2 and Q.5 were graded automatically by Blackboard. For this reason, clarity was provided in the question with respect to the units that the result must be reported in and the rounding of decimals must be specified. With this approach the student can still obtain part marks for the method employed by assigning marks to either a follow up question (Q.3 is a follow up of Q.2) or via a prior question (Q.4 requires the specification of the formula to solve Q.5). The assessor grades the questions that require the detailing of the method used (Q.3 and Q.4 in the case of the question in Table 1) manually.

There are some minor logistic issues to be considered that have a notable impact on the student-side experience. The assessor has the option to allow students to view the auto graded question results as they submit an answer, after the complete test is submitted or post-grading of the entire class. The method that may pose the least in-test or post-test stress is to allow the students to view the results only after the entire class has been graded for a particular assessment.

Blackboard creates a grade column for an assessment when an assessment is deployed, even though the assessment may not be available to students. This column, by default, is available for the students to view in their individual grade centres. Thus, students can view their grades as the assessor completes grading the respective student's assessment. Subsequently, it is advisable for the assessor to hide this column from students' view until the entire class is graded and the assessor is confident and has met the institutional requirements to disclose the grades to the students.

Various questions required a structure that varied from the one discussed in Table 1. The theory questions were presented as essay questions that were graded manually. Thus, the theory questions structure remained unchanged. Questions that required the calculation of multiple values, such as in truss analysis, were presented as multiple fill in the blanks, which were graded automatically. However, multiple solution options should be provided to ensure that all forms of the correct answer are considered. In this case, the method is not assessed - which is still in line with how the assessment was graded in the original paper-based assessment. One of the challenges that remain is how to structure a question that requires the student to sketch a solution. For example, the drawing of shear force and bending moment diagrams.

Table 2: Comparison of the structure of the Paper-based and online-based version of a question.

Original paper-based version of the question		Online-based version of the question	
Question	Mark Allocation	Question	Mark Allocation
A clevis and a plate are joined by a bolt as in Figure 2. The diameter of the bolt is [d]mm.		Q.1. A clevis and a plate are joined by a bolt as in Figure 2. Is the bolt in single or double	

The shear stress is [t] MPa. The force is [P] kN. Take G = [g] GPa. a.) Is the bolt in single or double shear? b.) Calculate the shear stress in the bolt. c.) Calculate the shear strain in the bolt.	(2) (5) (3)	shear? Q.2. A clevis and a plate are joined by a bolt as in Figure 2. The diameter of the bolt is [d]mm. The force is [P] kN. Take G = [g] GPa. Calculate the shear stress in the bolt in MPa. Provide the answer to two decimal places. Q.3. Explain the method you used to get to the answer in the previous question. You may use formulae. Q.4 What is the formula that relates the shear strain (y) to the shear stress (t) and the modulus of rigidity (G)? Use / for divide and * for multiply. Q.5. A clevis and a plate are joined by a bolt as in Figure 2. The diameter of the bolt is [d]mm. The shear stress is [t] MPa. Take G = [g] GPa. Calculate the shear strain in the bolt. Provide the answer to five decimal places.	(2) (2) (3) (1) (2)

Source: Authors' own

4.2. Moderation and Evidence Collection

Across all universities in South Africa that offer Engineering, the Institutional and Engineering Council of South Africa (ECSA) requirements must be adhered to in terms of the moderation processes and evidence collection applied across all Engineering modules. The module evidence file is a compulsory ECSA requirement, as all modules must have a file with evidence of all aspects of the module. The module evidence file, commonly referred to as the ECSA file, is used as evidence during the ECSA program accreditations. In terms of moderation of online assessments, the ideal scenario would be to have a mechanism that allows for dual grading of a single assessment. In this way, the assessor and moderator could provide individual grades and consolidate the grades for the moderated scripts during the moderation and approval processes. However, at the time of this study, Blackboard only

provided this option in the case of assignments. Thus, all scripts were downloaded to a spreadsheet file, which the moderator graded. In this module, the moderated spreadsheet was printed to serve as evidence in the compulsory module evidence file. The excel file does not provide the moderator with any of the grading notes that the assessor provides to a student. Thus, for this particular module, the assessor may need to find a way to provide the moderator with access to the module if the moderator requires access to the grading notes.

4.3. Assessment Security and Technical Glitches

In this particular module, assessment security in online assessments poses unique challenges that are not present in paper-based assessment. Primarily, the use of a lockdown browser is vital to ensure that the student(s) being assessed is locked into the test and does not have access to any non-permitted software or information via the computer or learning management system. Furthermore, a password, that is only obtainable in the proctored assessment venue, must be set to prevent a student from accessing the test outside of the proctored venue.

To ensure that a student does not obtain the password leave the venue and complete the test in a non-proctored venue, a strict attendance and submission register should be used. Thus, when a student enters the venue they must sign to prove that they have attended the test. Prior to leaving the venue, the student must sign and state the time, which serves as evidence that the assessment is submitted. Should any academic transgression occur, the submission time is used as a security measure.

In this particular instance, the institutional policy regarding online assessments is that the student should be granted two attempts within the time limit and that forced completion should not be activated. The logic behind the prescription of two attempts is to ensure that the student has recourse in the event of a technical glitch. Forced completion results in the assessment being automatically submitted when the time expires, if the computer crashes or a network failure occurs. However, based on experience from the 2018 cohort of this particular module, it is preferable to avoid forced completion in case of a computer crash or network failure. The affected student can be moved to an alternative computer to continue the assessment where all saved answers restored. However, the assessment is not automatically

submitted when the time expires. In a proctored venue, the time limit can be enforced and adherence to this can be monitored via the assessment logs on the instructor side. It is preferable to have access to network updates and maintenance schedules to ensure that an assessment is not scheduled during those periods as this may compromise the system stability. It is advisable to provide the students with a fill in paper-based copy of the test in the event of a complete network failure so that the assessment cannot be completed.

4.3. Impact on Grading Timelines

In this particular content, the time required to grade the online-based semester tests and examination significantly decreased in relation to the paper-based assessment. The grading of the semester tests, uploading of the marks and collection of sample scripts for compulsory module evidence files, on average, required five days of dedicated work. The online-based semester tests required one full day of dedicated work to complete all of the above processes. In the case of grading of the examination, the added steps of auditing, moderation and mark approvals required ten days of dedicated work for the paper-based assessment. The online-based examination required four full days of dedicated work to complete all of the above processes. The collection of evidence, moderation and approval processes for the examination required the same amount of time in both the paper-based and online-based assessment. However, the grading and auditing of the scripts reduced the timeline in this particular context.

5. Conclusion and Recommendations

The findings from this study contribute to the knowledge of online assessment and literature in a number of ways. Firstly, in this particular context, the results from this study validated the research hypothesis, which suggested that a shift from a paper-based to an online-based assessment reduced the grading timelines significantly which in turn resulted in students receiving feedback in reduced time. Secondly, the results suggest that to ensure that the online-based assessment preserved the macro-structure of the original assessment approach in a large classroom, questions need to be fragmented and clearer guidance should be given regarding units to be used and the rounding of values. Thirdly, adjustments need to be made to the moderation and evidence collection processes to ensure that these processes remain aligned with the institutional and professional body (ECSA) requirements. Fourthly, whilst

the grading timelines were reduced in this particular context, there was a minor increase in administrative load, which is vital to ensure that assessment security is preserved and that technical glitches are mitigated.

Lastly, the findings from this study also suggest that when applying online assessment, it is important to find a viable method to assess questions that requires the student to sketch a solution. While there are applications that would allow for the sketching to be done on the computer, these applications require the student to exit the lockdown browser environment which creates assessment security concerns.

While this study finds that online assessment in a large classroom is useful in many ways, more research needs to be conducted into various aspects of online assessment. For example, it would be useful to investigate whether specific online assessment tools are more suited to certain disciplines. In addition, an investigation into effective online assessment for smaller classes may prove more effective to smaller learning environments. Lastly, an investigation into the learning management systems on the South African market and their capabilities could likely assist educators in choosing an online assessment platform that best suits their teaching environment.

6. References

Bloom, B.S., Hasting, J.T. and Madaus, G.F. (1971). *Handbook on Formative and Summative Evaluation of Student Learning*. New York: McGraw-Hill Book Company.

Gaytan, J., & McEwen, B. C. (2007). Effective online instructional and assessment strategies. *The American Journal of Distance Education*, *21*(3), pp. 117-132.

Great Schools Partnership. (2015, October 11). The Glossary of Educational Reform – Assessment. Retrieved from: https://www.edglossary.org/assessment/.

Hench, T. (2014). e-Assessment: past, present and future. *International Journal of e-Assessment, 1*(1). Retrieved from: https://www.researchgate.net/publication/ 273001575_e-assessment_Past_Present_and_Future.

Hlalele, L. (2016). *University of the Witwatersrand residence students' perspectives on factors that promote or hinder academic success*. (Unpublished doctoral dissertation). University of Witwatersrand, Johannesburg, South Africa.

Paré, D. E., & Joordens, S. (2008). Peering into large lectures: examining peer and expert mark agreement using peerScholar, an online peer assessment tool. *Journal of Computer Assisted Learning*, *24*(6), pp. 526-540.

Shepard, L. A. (2000). The role of assessment in a learning culture. *Educational researcher*, *29*(7), 4-14.

Sondlo M. (2013). *A Comparative Study of Student Retention and Throughput in a Postgraduate Distance Education Programme*. (Unpublished master's dissertation). University of Pretoria, Pretoria, South Africa.

South African Qualifications Authority (SAQA). (2000). *The NQF and Standards Setting*. Retrieved from http://www.saqa.org.za/docs/pol/2003/standard_setting.pdf.

Yin, R. K. (2011). *Applications of case study research*. London: Sage.

ATTITUDE AND PERCEPTION OF TEACHERS AND PARENTS TOWARD INCLUSIVE EDUCATION OF CHILDREN WITH VISUAL IMPAIRMENT IN OYO STATE, NIGERIA

Adebayo Komolafe

University of Ibadan, Nigeria

totooootun@yahoo.com

Abstract

This paper examines the attitude and perception of teachers and parents toward inclusive education of children with visual impairment in Oyo State, Nigeria. Descriptive Survey research design of the correlational type was adopted. A total of 100 parents and 50 teachers making 150 participated in the study two stages probability sampling was used for the study. Purposive sampling technique was used to select the schools. Simple random technique was employed in the selection of both teachers and parents; r = 0.76. Questionnaires was used for data collection, the reliability was .76. Four hypotheses were formulated and tested at 0.05 level of significance. Data were analysed using Pearson Product Moment Correlation (PPMC) tool. There was positive significant relationship between teachers perception and inclusive education(r=.159, N=50, P<0.05). Positive significant relationship also existed between teachers attitude and inclusive education(r=.104, N=50, P<0.05). Significant relationship existed between parent perception and inclusive education(r=.391, N=50, P<0.05) and parent attitude and inclusive education(r=.579, N=50, P<0.05). Statistically significant difference was found to between teachers' perception and parents' perception toward inclusive education. There equally existed statistically significant difference between teachers' attitude and parents' attitude toward inclusive Education. It was recommended among others that parents and teachers should show love to the students with visual impairment.

Keywords: Attitude, Inclusive Education, Perception, Visual Impairment

Introduction

Visual impairment is a restriction to vision. It is an ophthalmological difficulty that may not allow an individual to acquire educational information through the traditional or better still, a conventional form. Adetoro (2012) and Eskay and Chima (2013) viewed visual impairment as an ophthalmological challenge that limits an individual's ability to access visual

information. Visual impairment includes all difficulties that may be associated with one's vision. From the perspective of the field of Special Education, the causes of visual impairment ranges from heredity, accident, wrong nutrition, birth defects, diseases and infections to unknown causes (Komolafe, 2016). Also in Special Education there are three categories of visual impairment (Onuigbo, 2007). These are: the total blindness, low vision and partial sightedness. Total blindness is inability to read and write print after all corrective optical measures must have been taken (Komolafe 2000). The low vision has restrictions in far vision. This restriction or limitations, calls for specialised services. The reason being that they may not be able to use the residual vision effectively and efficiently. The partial sightedness is as a result of refractive errors which are optically corrected. The World Health Organisation (WHO, 2012) recognizes three levels of visual impairments. There is a slight variation from Onuigbo (2007). These are normal vision, low vision and blindness.

However, the focus of this paper is on low vision and blindness. The reason being that the two categories may result from a reduced visual acuity, restricted field of visioin and imperfect colour vision. All these lead to the use of specialised services to facilitate learning; of which, the third category – partial sightedness – may not need. The inability to make functional use of the organs of sight which is profound loss of vision could have devastating effects on the individual. Some of devastating effects are negative emotions like grief, depression, hopelessness; just to mention but few. Also, difficulties may be experienced by individual with visual impairment in performing some daily living tasks such as fetching of water, sweeping, cooking, shopping and so forth. . There is restriction of movement; this is one of the most serious consequences of vision loss. The student may not be able to go around independently. A student with visual impairment is most likely to withdraw and isolate him/herself perhaps, as a result of limitation mobility. There is no doubt that his inability to interact with peers or classmates may affect his relationship. Other effects are poor self-concept, negative self-image and the list is endless.

With these plethora of problems associated with individuals with visual impairment plus highly technical nature of education and the expensive nature of their education, a lot more of school age children with visual impairment are out of school (WHO, 2014). Provision of education to persons with special needs passed through phases. For instance, from segregation integration and inclusive system of education. Each phase emerged as a result of the weakness or weaknesses identified in the previous phase. Within this context, inclusive

education (IE) emerged as a result of the weaknesses identified with integration. Originally, the primary focus of IE was on the persons with disabilities and learning difficulties. More recently, the scope of IE became widen to accommodate those who are at risk of marginalisaion. Advocates of IE considered it as opportunity for children with special needs to be given rights to education. Undoubtedly, Nigerian government through the National Policy on Education (2014) reiterated Nigerian child's right to equal educational opportunities. The ideals of IE negates segregation. Segregation which was one of the major flaws inherent in other forms or trend of educational placement; does not encourage a typical child to learn freely in the society of which he/she belongs. This was why Mittler (2000) submitted that the goal of IE is to restructure and reform the school in the direction so that all children can be part of all the social and educational opportunities offered in a school.

Inclusive education in its simplest form and meaning is educating children with disabilities without any form of segregation. It is also attending the school the students with disabilities would have attended if they were not with disabilities. The point the author is making is that IE was conceived to make all children irrespective of their differences be part of the social and educational opportunities offered by school. Nigeria have in principle, adopted the World Declaration on Education for All in 1990. The United Nations Educational Scientific and Cultural Organization, Salamanca statement for Framework for Action (1994). This was the basis for the practice of IE. Therefore, the attitude and perception of Key Stakeholders like the teachers and the parents may put at risk, the success of IE of persons with disabilities and especially those with visual impairment. This is the main concern of this author to investigate the attitude and perception of teachers and parents towards IE of children with visual impairment in Oyo State, Nigeria.

Literature Review

The role of teachers and parents in IE diverges from their traditional role. In the past, it was customary for teachers to identify learners who did not fit in the curriculum as early as possible with a view to referring them to someone else outside the school or to special classes or schools for special education. Teachers' attitudes have been specifically targeted, especially in inclusive settings. This is because of the link to student behaviour and achievement (Hunter-Johnson, Newton and Cambridge, 2014). These attitudes are multifaceted and vary from one teacher to another; nationally and globally. Teachers'

attitudes about working with students with disabilities in an inclusive classroom are complex (Berry, 2010). Teachers with a positive view often have confidence in their teaching ability and their effectiveness with students with disabilities who need a modified curriculum and special understanding of their ability and their emotional state. Teachers who hold a less favourable attitude towards inclusive education of students with visual impairment have a tendency to feel that inclusion makes too many demands and that students with disabilities should be taught separately, where they can receive individual instruction (Berry, 2010). Fuchs (2010) interviewed and observed elementary school teachers who taught in a regular classroom, especially as they taught students with disabilities in the mainstreamed, general classroom and found a positive disposition of the teachers towards inclusive education of students with disabilities. Waldron, Mcleskey and Redd (2011) revealed that principals can be important in helping teachers to be effective when working in inclusive settings. Generally, the teachers' attitude could be either negative or positive. Oladele and Ohanele (2012) investigated the attitude of Nigerian teachers towards IE. Found out that Nigerian teachers have negative attitude towards inclusive education. Conversely, Okoli, Olisaemeka and Ogwuegbu (2012) were of the opinion that attitude towards IE varies from teacher to teacher.

Perhaps one prominent strand of research is the study of teachers' perception. Jerlinder, Penermark and Gill (2010) proposed that; if teachers perceive inclusive education positively, the goals of inclusive education could be fulfilled. However, if the teachers perceive inclusive education negatively, it will create gaps between them and the students especially those with disabilities (Koster, Pijl, Nakken and Van Houten, 2010). Also, school teachers share similar perceptions regarding IE; some were negative, while some were positive. For instance, Wiggins (2012) reported a significant relationship between school teachers' perceptions of inclusion and classroom setting. This researcher concluded that teachers with experience in teaching within inclusive classrooms held more favourable perceptions toward IE than those teachers who did not teach in inclusive classrooms. Recent studies have shown that much has not changed over the past decades regarding high school teachers' perceptions of IE. For instance, Salami (2014) worked on teachers' perception of adequacy of their training for service delivery in inclusive settings. The results showed that respondents felt they were adequately prepared for some responsibilities in the inclusive setting.

Among the different factors which complicates the satisfactory educational development of children with visual impairment are parental attitudes both towards themselves and their children with visual impairment. Generally, attitude ranges from acceptance to the other extreme of rejection and feelings of guilt. Parents' attitude is very crucial and most important element in respect of children's education. Parents show different reactions from denial and isolation, anger, trading of blame, bargaining to acceptance. It is obvious that many parents or children with disabilities pass through similar reactions and emotional responses to get to the acceptance stage. It must however be noted that stage varies from parents to parents (Heward & Orlansky, 1988).

According to Scheepstra, Nakken and Pigl (1999) inclusive education was initiated by parents of children with disabilities. Although, according to them, parents' motives to place their children with disability in regular school might vary, they mainly choose a regular education setting because of the possibilities for their child to participate socially in the peer group. Parents hope and expect that physical integration – 'being there' – will lead to their child participation socially with the peer group.

Research on parental attitude towards inclusive education of students with visual impairment– for instance, Miller and Phillips (1992) and Jerlinder, Danermak and Gill (2010) have shown that parents seem to hold predominantly positive attitudes towards inclusive education. Besides the benefits of inclusive education, parents show concerns about inclusive practices. Some parents of children with special needs argue that a regular classroom is not an option for their child (Green and Shinn, 1994, 1995). They have concerns about the social impacts on their child, such as social isolation, rejection and bullying (Leyser and Kirk, 2004). Moreover, they are apprehensive that regular teachers are not trained well enough, have insufficient teaching time, and lack appropriate support and resources to educate their children properly (Fox and Ysseldyke 1997; Grove and Fisher, 1999).

Theoretical Framework

This work was guided by Perception Theory. This theory was developed by a German known as Immanuel Kant; who lived between the periods of 1724-1804. He argued that the human mind creates the structure of human experience, that reason is the source of morality, that aesthetics arises from a faculty of disinterested judgment, that space and time are forms of

human sensibility, and that the world as it is in-itself is independent of humanity's concepts of it.

Kant was of the view that people's experiences are configured along with their state of minds. In Kant's view, the mind forms and make up experiences. The reason is that at abstract level, all human experience share similar configured features. To Kant, among other things, he believed, that space and time are important aspects of human experience. The implication of this view point is that our experience of things is always very great and impressive which is what our senses conveyed. Similarly, Kant believed that the mind is not an empty container. Something must be giving order to the incoming data to be processed by the mind. This something coming from outside to Kant, is image. These images must be stored in order as they were received. It is the mind that however does the ordering through the mind.

One very pertinent aspect of this theory is that of sense perception through imagination or our own mental activity. This may go beyond ordinary. This belief introduces a dichotomy between the object being perceived (sense perception) and the given of the senses (interpretation).

At this juncture, it is imperative to point out that the way teachers and parents perceived the inclusive education practices and implementation may definitely influence their attitude to the same system of education (inclusive education). The attitude may either be positive or negative which may be the interpretation as theorized by Kant. This is one of the reason the Perception Theory by Kant has been considered relevant to this study

Statement of the Problem

In Nigeria and indeed, world over; very few individuals with visual impairment have received formal education. In a bid to removing barriers to the education of these set of persons, IE was introduced. However, there are varying opinions on the system (IE) from major stakeholders especially in the special educational needs. Scholars had extensively dwelt on the implementation of IE. Some scholars who worked on attitude and perception did not carry the parents along. Few that carried parents along were not work done in Oyo State, Nigeria.

This study, therefore, examined the perception and attitude of teachers and parents towards Inclusive education of children with visual impairment in Oyo State, Nigeria.

Hypotheses

Four hypotheses were tested at 0.05 significant level and these include:

1) That there is no significant relationship between teachers' perception and attitude toward inclusive education

2) There is no significant relationship between parents' perception and attitude toward inclusive education

3) That there is no significance difference between teachers' and parents' perception toward inclusive education

4) That there is no significant difference between teachers' and parents' attitude toward inclusive education

Methodology

The descriptive survey research design of the correlational type was adopted for this study. This is because the researcher never attempted to manipulate all the variables of interest in the study.

The population for this study comprised all teachers and parents of children with visual impairment along the length and breadth of Oyo State.

A total number of one hundred (100) parents' and fifty (50) teachers participated in the study. Two stage probability sampling was used for the study. First, purposive sampling technique was used to select three schools in Oyo State, Nigeria. These schools were Omoyeni School for the blind, Methodist Grammar School and Ogbomoso School for the blind all in Oyo State – Southwestern, Nigeria. Later on, simple random technique was employed in the selection of both teachers and parents.

Data for this study were collected through a questionnaire adapted from a study carried out by Koseanna Davidson of Texas University and College of Education developed by Wilezenski (1992). The instrument named as Modified scale for parents and Teachers' Attitude toward inclusive education. The questionnaire comprised two parts, Part A deals with the demographic information of the respondents, while part B contains 40 items related to Attitude and Perception of teachers and parents towards inclusive education of children with visual impairment. A five (5) scale is used to identify level of agreement on a statement given. The scale were as follow: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree

and 1 Strongly Disagree. Also, three (3) scales ware used to identify parents respondents level of argument on statement given. The scales were as follows: Yes, Not sure and No. Earlier, the psychometric property of the instrument were found to be reliable with reliability value of 0.857% this was however revalidated and was found to be 0.76%

Data collected were analysed using Pearson product moment correlation (PPMC) to capture the level of linear relationship among the variables while t-test was used to test for the significant difference(s) if it exists among the variables.

Results

Ho$_1$:   That there is no significant relationship between teachers' perception and attitude towards inclusive education.

Table 1: Pearson Product Moment Correlation showing the relationship between teachers perception and attitude toward inclusive education.

Variables	Mean	S.D	N	R	Sig (P)	Remark
Inclusive Education	11.64	5.632	100	-		
Teacher perception	33.37	11.729	50	.159**	0.15	S
Teachers Attitude	37.64	12.484	50	.104**	.011	S

Correlation is significant at 0.05 level

Table 1 shows the relationship between teachers' perception and attitude toward inclusive education. The table reveals that there is positive significant relation between teachers perception and inclusive education (r=.159, N=50, P<0.05) and that positive significant relationship also exist between teachers attitude and inclusive education (r=.104, N = 50, P<0.05). Thus, the null hypothesis is hereby rejected.

Ho$_2$:   That significant relationship does not exist between parent perception and attitude toward inclusive education.

Table 2: Pearson Moment Correlation showing the relationship between parent perception and attitude toward inclusive education.

Variables	Mean	S.D	N	R	Sig (P)	Remark

Inclusive Education	11.64	5.632	100	-		
Parent perception	28.65	9.433	50	.391**	.041	S
Parent Attitude	22.36	1.083	50	.579**	.022	S

Correlation is significant at 0.05 significant level

Table 2 presents the nature of relationship between parent perception, attitude and inclusive education. This result reveals that positive statistically significant relationship exists between parent perception and inclusive education (r =.391, N=50, p<0.05). Thus, the null hypothesis is hereby rejected.

Ho₃: That there is no significant difference between teachers and parent perception toward inclusive education.

Table 3: T-test Analysis of significant difference between teachers and parent perception towards inclusive education of children with visual impairment.

Variables	N	Mean	S.D	t	df	Mean difference	Sig (p)	Remark
Teacher perception	100	32.86	3.916	83.92	99	32.86	.046	S
Parent perception	100	21.66	3.750	57.76	99	21.66	.033	S

Table 3 shows the difference between teachers and parents perception towards inclusive education of children with visual impairment. The table reveals that there is significance difference between teachers' perception and parent perception towards inclusive education. The result further confirmed that teachers have higher perception toward inclusive education of students with visual impairment more than the parents. Thus, the earlier null hypothesis is hereby rejected.

Ho₄: That there is no significant difference between teachers' and parent attitude toward inclusive education of children with visual impairment.

Table 4: T-test Analysis showing the significant difference between teachers' and parent attitude towards inclusive education of children with visual impairment.

Variables	N	Mean	S.D	t	df	Sig (p)	Remark
Teacher Attitude	100	33.41	4.149	80.53	99	.038	S
Parent Attitude	100	21.66	3.75	37.76	99	.044	S

Table 4 present the difference between teachers' and parent attitude toward inclusive education of students with visual impairment. The result reveals that there exist significant difference between teachers' attitude and parent attitude toward inclusive education. It is also evident from this result that teachers possess higher degree of attitude toward inclusive education than the parents. Thus, the null hypothesis is hereby rejected.

Discussion of Findings

The position of teachers and parents in educating the persons with visual impairment and in particular in the inclusive system of education, is very crucial and strategic. It is crucial because both the teachers and parents are key stakeholders in the system. Consequently, teachers' and parents' attitude and perception could influence the course of inclusive education. The author, in this study found positive significant relationship between teachers' perception and attitude towards inclusive education. The way the teachers thought of inclusive education thereby influences inclusive education. For instance, earlier study of Campbell, Gilmore and Cuskelly (2003) in their work investigated the perception and attitude of students-teachers towars inclusive education of students with visual impairment and found out that students teachers' attitude and perception were higher hence, greater ease while interacting with persons with disabilities. Similarly, the findings of Chuckwuemeka and Uchechukwu (2012), corobarated with Campbell, Gilmore and Cuskelly (2003). Hunter-Johnson, Newton and Cambridge (2014) in their study on the attitude of teachers and parents towards inclusive education, teachers had moderate levels of acceptance of students with disabilities parents. In the study, teachers who had Masters Degrees had more positive views toward inclusion than teachers with Bachelor's Degree. This finding suggests that the education level of the teachers is a possible influential factor on teachers' attitudes and their perception towards inclusive education. This was against work of Oladele and Ohanele (2012) that found out that Nigerian teachers have negative attitudes towards inclusive education.

Similarly, the study found positive significant relationship between parents' attitude and perception and inclusive education. The findings of this study seems very interesting because of the parents' optimism that their wards could benefit from inclusive education; hence, their positive attitude and perception. Also, the findings negated Olagunju and Aranmolate (2012) who found out that parents' attitude and perception towards inclusive education were positive probably because of their level of education that may be lower than that of the teachers. One ordinarily would have expected that the attitude and perception of the parents would have been negative. The teachers' educational background, training and retraining, level of exposure against the parents should have made the difference.

Conclusion

It is apt to comment that the study concluded that teachers' attitude and perception toward inclusive education of students with visual impairment was very positive. Parents' attitude and perception are equally very positive. Hence, there was very strong nexus between teachers' attitude and perception towards inclusive education of children with visual impairment and also between parents' attitude and perception towards inclusive education of children with visual impairment, in Oyo State, Nigeria. The study also concluded that level of education may not influence parents' attitude and perception towards education of children with visual impairment in Oyo State, Nigeria. Teachers and parents belief that students with visual impairment can do well in the inclusive setting.

Recommendations

- Need for the teachers to undergo regular retraining programmes to update their knowledge;
- More opportunities for collaborations between the parents and the teachers should be created to enable robust discussion on the progress of their children or wards.

References

Adetoro, N. (2012). Alternative format preferences among secondary school visually impaired students in Nigeria: *Journal of Librarianship and Information Science,* 44(2), 90-96.

Berry, R. A.W. (2010). Pre-service and early career teachers' attitudes toward inclusion, instructional accommodations and fairness. Three profiles: *The Teacher Educator* 45, 75-95.

Campbell, J., Gilmore, L., & Cuskelly, M. (2003). Changing student teachers' attitudes towards disability and inclusion: *Journal of Intellectual and developmental Disability* 28 (4), 369-379.

Chukwuemeka, E. J. & Uchechukwu, O. S. (2012). View of Teachers in Ibadan on Inclusive Education in Nigeria: *African Journal of Inclusive Education,* 1 (1).

Eskay, M. & Chima, J. N. (2013). Library and Information service delivery for the Blind and Physically challenged in University of Nigeria Nsukka Library: *European academic research,* 15, 625-635.

Federal Government of Nigeria (2014). National Policy on Education in Nigeria Revised Edition Abuja (NERDC).

Fox, N. E. & Ysseldyke, J. E. (1997). Implementing Inclusion at the Middle School Level: Lessons from a Negative example*: Exceptional Children*, 63 (1), 81-98 .

Fuchs, W. (2010). Examining Teachers' Perceived Barriers Associated with Inclusion: *STRATE Journal*, 19 (1) , 30-35 .

Green, S. K., & Shinn, N. R. (1995). Parent Attitudes about Special Education and Reintegration. What is The Role of Student Outcomes?: *Exceptional Children*, 61 (3), 269-281 .

Green S. K & Shinn, M.R (1994) . Parent attitude about special education and reintegration: what is the role of student outcome?: *Exceptional children*, 61 (3) , 269-281 .

Grove, K. A. & Fisher, D. (1999). Entrepreneurs of Meaning: Parents and the Process of Inclusive Education: *Remedial and Special Education*, 20 (4) , 208-215, 256 .

Heward M, & Orlasky A. (1988) . *Exceptional children.* Columbia: Merril Publishing Company.

Hunter-Johnson, Y., & Newton, N.G.L. & Cambridge A. (2014). Breaking The Silence of Mainstream Teachers' Attitude Towards Inclusive Education in the Bahamas: High School teachers' perceptions: *The Qualitative Report*, 19 (84), 1-19.

Jerlinder, K., Danermark, B. & Gill, P. (2010). Swedish Primary – school teachers' Attitudes to Inclusion – The Case of PE and Pupils with Physical Disabilities: *European Journal of Special Needs Education,* 25 (1) , 45-57 .

Kaster, M. H. Nakken, S. J., Pijl, & E. Van Houten, (2010) . Being part of the peer group: A literature study focusing on the social dimension of inclusion in education. *International Journal of Inclusive Education,* 13, 117-40.

Komolafe, A. F. (2016). *Teaching students with low vision. In Gbenga Adewale J. (Ed) Issues in Teacher Education in Africa.* Cameroun: Educational Assessment Research Network.

Komolafe A. F. (2000). *Educating the Exceptional Children: The Position of Guidance and Counseling.* Lagos: Rothgate Nig. Ltd.

Leyser, Y., & Kirk, R. (2004). Evaluating inclusion: An examination of Parent Views and Factors Influencing Their Perspectives: *International Journal of Disability, Developmental and Education,* 51 (3), 271-285.

Mittler, P. (2000). *Working Towards Inclusive Education social contexts*: London: David Fulton Publisher.

Miller J. & Philips A. (1992) . Three-year follow-up and implications of a mindfulness-based stress reduction intervention in the treatment of anxiety disorders: *General Hospital Psychiatry*, 17, 192-200.

Okoli, B. I., Olisaemeka, A N., & Ogwuegbu, D. C. (2012). Attitude of Special Educators toward Inclusive Education for persons with visual impairment in Nigeria: *African Journal of Inclusive Education,* 1 (1) .

Oladele & Ohanele (2012). *Teachers' perception of inclusive education*. Oyo, Nigeria: Book of Abstract.

Olagunju, MKO & Aranmolate, T. R. (2012). Awareness Level, Attitudes and Perception of Stakeholders on Inclusive Education Practice in Africa (Nigeria): *African Journal of Inclusive Education,* 1 (1).

Onuigbo, C. E. (2007). Home environmental failures as correlates of social adjustment of pupils with hearing impairment. *Journal of National Center for Exceptional Children*, 12 (1) , 184-197 .

Salami, I. A. (2014). Inclusive early childhood education in Nigeria: the journey so far: *The Journal of International Association of Special Education,* 15 (2), 118-126.

Scheepstra, A.J.M., H. Nakken & Pijl (1999) . Contacts with classmates: The social position of pupils with Down's syndrome in Dutch mainstream education: *European Journal of Special Needs Education,* 14, 212-20.

UNESCO (1994) . *The Salamanca Statement and Framework for Action on Special Needs Education. Adopted by the World Conference on Special Needs Education*: *Access and Quality*. Salamanca, Spain, 7-10.

Waldron, N., & McLeskey, J. (2011). Establishing a Collaborative Culture through Comprehensive School Reform: *Journal of Educational and Psychological Consultation,* 20, 58-7 .

WHO (2015 . *Chapter 1 products and technology: WorldHealth Organisation (June 9, 2014)*: http://apps.who.int/classifications/icbrowser/ .

WHO (2012 . *WorldHealth Organization*: www.who.int>gho>publications>2012 .

WHO (2014). *WorldHealth Organization*: www.who.int>gho>publications>2014 .

Wiggins, (2012). Attitudes and Perceptions towards Disability and Sexuality. *International Journal of Disability*, *Development and Education*, 59(4).

Wilczenski, F. L. (1992). Measuring Attitudes Towards Inclusive Education. *Psychology in the Schools*, 29, 307-312.

TECHNOLOGY-BASED NON-FORMAL EDUCATION FOR HERDERS IN LESOTHO: A LITERATURE REVIEW

Selloane Pitikoe

University of KwaZulu-Natal; Edgewood campus

mofumahali@gmail.com

Abstract

Technology-based Non-formal education (NFE) can potentially provide access to autonomous learning opportunities to the disadvantaged groups such as Basotho herders. The concern of this paper is on mobile media devices such as cellular phone, iPad, iPod and Tablets as tools for facilitating NFE in Lesotho. The paper follows a literature review approach and the research population are the published journal articles, books and reports. There are three research objectives that the paper seeks to address. (1) It describes how NFE is offered in Lesotho with regards to wider education access; (2) It identifies the best practice models from elsewhere in the world that evidence of success in the implementation of mobile devices in NFE provision. (3) The paper identifies how the herders can benefit from the technology-enhanced learning. While Lesotho like other countries has been directly affected by the massive digital development, the country still lags behind in technology-based education. Worthy to mention is the effort of Lesotho to pilot the digital learning programmes that did not live to see the light of the day because of poor digital infrastructure and lack of financial supports. It can therefore be argued that NFE provision in Lesotho is mainly offered through a face-to-face approach to learning. The author of this paper envisages that the deliverables of this paper will further inform Lesotho's NFE policy and practice change agenda.

Keywords: Non-formal Education; Technology-based learning; e-learning; Information Communication Technology; Mobile devices; Herders

INTRODUCTION

The deliberations under this section centre on distance education. The basis for discussion is on the teacher and learner separation in terms of space and time. Distance education refers to a teaching and learning mode that moves the education provision beyond the confines of the four traditional classroom walls. It is a flexible and technology-supported mode where the learners' and the tutors' physical presence is removed by space and time (Perraton, 2007).

Literature refers to this separation as the transactional distance (Benson & Samarawickrema, 2009; Kassandrinou, Angelaki & Mavroidi, 2014). The transactional distance as a theoretical concept is traced back to the work of Dewey and Bentley in 1949 who discovered that regardless of the learners and the tutor being separated they also develop some behavioural implications as coping mechanisms to overcome their predicament. For instance, their separation fosters an increased need for constant communication (Kassandrinou et al., 2014).

Distance education came into being later in the process, as a result of the work done by Michael Youth and Brian Jackson who piloted the National Extension College project in 1963 whose aim was to inform the establishment of the Open University of Britain (Perraton, 2007). This pilot phase looked into the effectiveness of the technology-based teaching and learning practices for the then proposed refugee programmes aimed for Palestinian teachers and the Ecole Normale Supérieure training programmes.

The globalised world of today has indeed popularised the mobile devices such as cellular phones to an extent that Basotho herders, despite their remoteness are in possession of cellular phones. Arguably, there is a need to explore further the use of these mobile devices using a broader lens that penetrates beyond the ordinary use of such devices for communication. This implies a need to establish a deeper understanding of how the mobile devices can facilitate access to teaching and learning resources of NFE programmes that target Basotho herders at their own convenient time and place.

Perraton (2007) identifies some of the benefits of learning at a distance to include: a) the economic benefit, in that fewer resources both human and material are needed to drive the process forward. Equally important is that fewer teachers can address significantly large classes at the same time; b) the provision is flexible to accommodate learners who have other competing responsibilities such as family, job, social responsibilities to study at their own space and time convenient to them and c) its ability to broadcast over a wider coverage enables even the widely sparse leaners benefit from the teaching and learning activities (Carlsen et al., 2016; Vaičiūnienė, Mažeikienė & Oleškevičienė, 2015). The value that comes with distance learning has resulted in an increase in the recognition of the potential role of distance learning as the next logical step in the delivery of teaching and learning programmes. Based on this assumption, the mobile nature of the herding practice makes distance education a potential provision that can counteract the limitations that the

mainstream provision encounters by opening digital access doors wider and accessible to Basotho herders.

Emphasis is made on the need for education provision to include teaching and learning activities that broaden the learners' choices of what to learn, how to learn, when to learn and where to learn without being domiciled in the classroom environment. In other words, the conventional teaching and learning mode alone cannot fully accommodate the diverse social needs and educational gaps. Therefore, education policy and practice has to take into cognisance a need to provide lifelong teaching and learning that will be applicable to meet the social survival skills as well as the labour market skills.

The problem

Livestock herding in Lesotho is a cultural practice that is common in the rural areas. Herding is semi-nomadic and practiced under a hard to reach terrain. In the process access to education for Basotho males becomes a challenge. Given their herding lifestyle NFE is perceived as the most appropriate provision that can accommodate the herders' needs and lifestyle. However, due to the rugged terrain, both herders and the service providers are not within reach of each other for services as well as service provision respectively. Nonetheless, the digital development has made mobile devices accessible even to the marginalised and isolated social groups such as Basotho herders.

Regardless of the ease of access to mobile devices, Lesotho is still lagging behind in terms of implementing technology enhanced NFE provision. This is because Lesotho's policies that support the NFE provision (NFE and adult education policy and the Open Distance Learning policy) have not been approved as working documents that can legally support this provision (MoET, 2008). In the absence of these policies, NFE in Lesotho remains on the periphery as a second class provision of lower quality than formal education which Siaciwena (2000:13) refers to as "paraformal education" which substitutes the formal provision.

The fact that NFE lacks access to financial resources due to unratified policies, results in lack of political will and the human capital.. As a result, Lesotho's NFE provision is currently offered by Non-Governmental Organisations (NGOs) under the umbrella of the Lesotho Non-Formal Education Association (LANFE) and the Lesotho Distance Teaching Center (LDTC) – government department under the MoET. While the department of NFE in Lesotho

coordinates all forms and provisions nationally. Much of the learning programmes that target the herders centre on the experiential learning model with emphasis on learning by doing. For instance, in some cases learners would be engaged in poultry projects, arts and crafts or horticulture in order to align learning in such a way that it mitigates the prevalent social ills. UNESCO (1995) also mentioned a pipelined plan to introduce a bridging program that will fast-track the learners' entry into the tertiary education institutions without following the traditional enrolment process. Twenty three years down the line, progress pertaining to this proposed development still seems remote.

It is against this background that the paper seeks to address tow research objectives as follows: First, it describes how NFE is offered in Lesotho with regards to wider education access by all. Secondly, it identifies the best practice models from elsewhere in the world that evidence success in the implementation of mobile devices in NFE provision. Thirdly, the paper identifies how the herders can benefit from the technology-enhanced learning. In order to address these objectives the paper is outlined into the following sections. It begins with the literature review followed by the discussions, conclusion and suggestions.

LITERATURE REVIEW

The small monarchy of Lesotho was formerly under the British protection from 1868 until 1966 when Lesotho became independent. This colonial period met with a paradigm shift in the education provision from the holistic indigenous ways of knowing to make way for the Eurocentric education provision. The Eurocentric education curriculum was intended to serve the hegemonic interests of the colonisers (Dladla, 2018; Pratt, Louie, Hanson & Ottman, 2018). However, the education was not contextualised to meet the needs of the local communities. The colonial hangover still prevails in Lesotho's education (Lekhetho, 2013).

Lesotho's education comes in three main forms of formal (structured, teacher-led classroom type); Non-formal education (NFE) (dual provision – classroom based as well as beyond the classroom; a combination of non-credit and credit hour provision) and; informal education (incidental, unconscious learning through daily interaction with the social environment). There are three main sponsors of formal education in Lesotho. First are those schools that are run by the religious bodies the majority shareholder being the Roman Catholic Mission (RCM); followed by the Anglican Church of Lesotho (ACL) as well as the Lesotho

Evangelical Church (LEC) respectively. To a limited but rapidly growing interest are the Protestants - a legacy that the Kingdom of Lesotho inherited from the previous colonial government (Lekhetho, 2013). Second are the government owned schools which by far offer free education. While still in its infancy though, the third category comprises of the community owned schools. All the three categories are administered by the Ministry of Education and Training which ensures that all forms of resources being it financial, material as well as the human capital are provided.

Despite Lesotho's NFE provision contribution to the national literacy statistics, this provision also attracts the least attention of Lesotho's government in terms of political will as well as resource allocation (Pitikoe, 2017). This is because Lesotho's policies that support the NFE provision (NFE and adult education policy and the Open Distance Learning policy) have not been approved as working documents that can legally support this provision (MoET, 2008). In the absence of these policies, NFE in Lesotho remains on the periphery as a second class provision of lower quality than formal education which Siaciwena (2000:13) refers to as "paraformal education" which substitutes the formal provision.

Policy environment

Lesotho's policy environment recognises a need for universality and equity in education provision (Kingdom of Lesotho, 1993; Ministry of Education and Training (MoET, 2005) and the need for the mainstream education that advances the entrepreneurial skills of the learners (Government of Lesotho (GOL), 2000; Goscilo & Hashamova, 2010; Krätli, 2001; Mosia, 2014). As mentioned earlier under the problem sub-section of this paper, NFE remains the most appropriate provision that caters for the learning needs of the herders.

Notably critical is the fact that, NFE faces a few challenges repressing its successful execution (Pitikoe, 2017). The non-ratification of the key NFE poicies has indeed affected its effectice implementation as well as attraction of financial recourse. However, these barriers have not in anyway affected the deeply rooted perception of NFE as the best mode that can accommodate the herding lifestyle as well as the educational needs of the herders. The draft nature of these policies hinders their formal adoption as working documents for widening education access beyond the confines of the classroom (Pitikoe, 2017).

Embedded in the NFE national policies is the commitment to widen teaching and learning opportunities in such a way that they can be easily accessible to the underserved members of Basotho such as the herders (Osborne, Cutter & Ullah, 2015). The global concern on education as a redress towards poverty eradication has made education in Lesotho a pinnacle in the national planning debates. This implies a need for Lesotho to integrate digital tools in the NFE provision in order to meet the employment demands of the 21st century (Dalton, Mckenzie & Kahonde, 2012).

Information Communication Technology (ICT)

As an umbrella term, ICT refers to all forms of digital tools and platforms being it software or hardware that can facilitate communication and access to social services inclusive of distance learning (Vaičiūnienė, Romeris, & Mažeikienė, 2012). Literature identifies some of the benefits of technology-based learning as follows: its transformative nature from the traditional face-to-face type into a wider provision of good quality that is not domiciled in the classroom. Equally important is the fact that the "net generation" (Van Wyk, 2014: 370) of the 21st century learners is technology savvy. Therefore digital learning becomes an attractive endeavour that appeals to both their learning and social needs (Vaičiūnienė, Mažeikienė & Oleškevičienė, 2015; Gikas & Grant, 2013; Hylén, 2015).

electronic learning or E-learning refers to covers all forms of digital learning using the web-based digital platforms such as networked computers and portable devices - mobile phones as modes of instruction (Vaičiūnienė, Mažeikienė & Oleškevičienė, 2015; Gikas & Grant, 2013). Seemingly, the introduction of the Web 2.0 online teaching and learning resources has increased interactive and collaborative learning where content creation, information and resource sharing become the responsible of the digital community (Van Wyk, 2014) hence the term social media.

The few studies that were conducted on the herders in Lesotho Nigeria, Sudan, Uganda and Ethiopia reveal that the curriculum design on programmes that target the herders has to place their life experiences, daily routine as well as their learning needs at the centre of the design process. These issues were supported in the studies that were conducted on the early school leavers from Uganda, Lesotho and Sudan (Krätli, 2001; Pitikoe, 2017; Zeelen et al., 2010). Some herders' case studies were also conducted in Ethiopia where the focus was on the promotion of basic literacy and numeracy and the empowerment of the herders with practical

skills that were readily applicable in their herding career in order to make them better at what they do (Pitikoe, 2017).

Central to the discussions in these case studies was the relevance of the NFE content and its implications to learner-turn out and retention in NFE programmes. In the case of Nigeria for instance, the curriculum developers modified the conventional curriculum such that it included animal and crop husbandry. The assumption was that, the herders' passion was more on learning skills that would empower them towards livestock quality improvement rather than the mere numeracy and literacy skills (Kratli, 2001).

In Ethiopia, however, emphasis was on bringing about a significant change in the lives of the nomads (Krätli, 2001). In other words, education was seen as a mechanism that transforms the strong-held beliefs and attitudes of the Maasai by introducing them to know forms of knowledge that was relevant to their herding practice. Therefore, the programmers integrated the traditional knowledge within the modern one. Thereafter, the Maasai were trained on the new system with the impression that they would be able to apply the new knowledge to their various real life herding challenges. Indeed the newly acquired skills were integrated into the herding career but it also enabled the Maasai to integrate back into their communities as change agents who catalysed a positive change.

The key message conveyed by these programmes is that; firstly, they were designed to address the common challenges that the African community development problems face while striving to bring about a significant change in the lives of the served communities. Secondly, the programmes were also designed with the beneficiaries as the main focus of the programming in that, the learning had to appeal to their learning needs and desire to learn while also adding a significant value to their social and economic lives. Thirdly, the learning was designed with the concept of immediacy in mind in order to sustain the newly acquired knowledge. What stands out in all these cases is the need for the curriculum as praxis that extended beyond the traditional basic literacy into income generation opportunities for economic empowerment, the situation which is also common in Lesotho (Pitikoe, 2017).

Technology-based learning

This section presents some distance learning models that worked in United Kingdom (UK) and South Africa that Lesotho can learn from and customize to meet the country's NFE

needs. For instance, social media was employed in teaching and learning in the health professional in UK (Pittenger, 2013). Conducted over a period of 15 weeks, the students were independently tasked to design an online strategy that would facilitate collaborative online learning for health interprofessional education programs. The findings discovered that the learners recommended the integration of collaborative learning in the multidisciplinary health programmes such as those, who enrol learners for distance learning programs. However, the results emphasized the need to exercise care in the program and content design (Pittenger, 2013).

In another study conducted by Hanover Research (2011), the potential of the cellular phones in increasing quality education while also removing access to education barriers were put to test. For instance, the University of Pretoria (UP) in South Africa integrated mobile devices in the form of cellular phones by incorporating text messaging in the distance teaching and learning activities. Through this approach UP used the text messages as a study guide and learner support system as well as for posting of mini-lectures on complex topics. Two years later, UP had successfully implemented a two-way communication system that allowed for real team communication and feedback between the students and the tutors. Based on the findings of their assessment study, UP concluded that the approach did not only improve the academic performance of the students, but it also bore a positive impact regarding the learners' course completion (Hanover Research, 2011). It can also be argued that the approach was economical in terms of money and time, while also attractive to the 21st century learners, who are technology savvy.

These two cases indicate the importance of learner-involvement in the design and implementation of programmes that directly affect their lives. The studies also reveal the need for flexibility in the programming of teaching and learning activities such that they become living documents that are aligned with the current global demands. Equally important is the expressed need for a paradigm shift where education becomes flexible and dynamic enough to equally accommodate the needs of all NFE learners in society.

Duleavy et al (2009) identifies the resourcefulness of mobile devices as learning tools and how the technological interfaces can significantly contribute in the construction of peoples' perceptions of knowledge and information generation: a) the world-to-the-desktop method which facilitates access to the existing knowledge and skills using the networked mobile

devices; b) the multi-user virtual environment (MUVE) which allows the learners to interact with a rich learning environment such as the digital objects and tools; and the c) augmented reality (AR) which allows the learners to engage with real life's physical environments using mobile devices. In these cases, mobile devices can come in handy as virtual tools that explain the simulated information from their mobile devices in order to explain a real picture in real life (Duleavy et al., 2009).This is to say that, given the isolation that come with herding the few studies on herders revealed their keenness to expand their knowledge base through technology. For instance, the findings by Pitikoe (2016) revealed that, some of the herders wanted to learn about computers which means that technology is not foreign to them. Equally important is the ability of the devices to engage learners in learning through physical environments. Evidence reveals that most of the herders learning happens through their interaction with the environment which makes mobile devices more relevant and appropriate to meet the contextual needs of the herders.

The paper is based on Lesotho's herding context and asserts that, more has to be explored on the ability of the herder owned cellular phones to include facilitation of out-of-school teaching and learning programmes for herders. The attractive feature of mobile media technologies in learning is that the learners' constant interaction with handheld mobile devices that are used as tools for real time learning that is contextualized to meet the immediate socioeconomic learning needs (Gikas & Grant, 2013) In order for such learning to qualify as mobile, teaching and learning devices have to be mobile, user-friendly, personal and portable enough to precisely fit into a lady's handbag or a gentleman' pocket as in the case of cellular phones (Gikas & Grant, 2013). The technology-mediated NFE teaching and learning comes with the benefits of opening education opportunities wider for ease of access by all groups of society including those that are marginalized and underserved such as the herders. However, what is missing in the available literature is the value that the herders will get from the digital NFE provision in Lesotho.

The migrant nature of the herding job coupled with their economic disempowerment necessitates education provision outside the classroom setting and facilitating its accessibility by the herders at times and places that are most convenient to them. One such approach would be a technology mediated distance education provision. Another important aspect of technology-based education is its ability to turn both formal and informal learning into a mobile practice.

MATERIALS AND METHODS

This chapter followed a literature review methodology, which examined various literature sources in the form of reports, books and journal articles. The key words that guided the author's search were: Non-formal education; technology-based learning; e-learning; Information communication and Technology, mobile devices and herders. A total of 31 sources were identified and included in the review process. The data analysis was done based on the relevance of the content to the two research objectives and the benefits of social media in promoting learning. The author also searched for best practice models elsewhere in the world, where social media was integrated in distance learning provision. The outcomes from this chapter will inform Lesotho's distance learning policy development and practice while also adding to the existing knowledge base on distance learning and social media. Researchers from other countries, who have similar research interests, may also equally benefit from these findings.

This paper seeks to address two research objectives as follows: First, it describes how NFE is offered in Lesotho with regards to wider education access by all. Secondly, it identifies the best practice models from elsewhere in the world that evidence success in the implementation of where mobile devices in NFE provision. Thirdly, the paper identifies how the herders can benefit from the technology-enhanced learning.

SUMMARY AND IMPLICATIONS TO LESOTHO'S NFE PROVISION

The main thrust of this paper is to examine how technology is integrate in the provision of distance education in other countries. The paper seeks to inform the current provision of distance education on ways how the current NFE policy and practice reform in Lesotho and advocates for a technology-mediated NFE.

How Lesotho offers NFE

Lesotho's NFE is offered under the umbrella on the Ministry of Education and Training. However, due to unratified policy documents that support the provision of NFE financially and skills wise, NFE is perceived as a lower status form of education. Therefore, it is mostly offered by NGOs through donor-support. The teaching and learning methods are face-to-face with no integration of technology. The face-face mode confines the education within space and time to the disadvantage of the marginalised groups of society such as herders.

The need for the teaching and practice to take into consideration the effects of herding culture and lifestyle in the development of teaching and learning activities was also highlighted.

What can we learn from the case studies?

The reviewed literature on case studies that used digital NFE revealed that digital learning in different contexts of –health, higher education as well as herding brings about positive results to the programme (Krätli, 2001; Pitikoe, 2017; Zeelen et al., 2010; Pitikoe, 2017). For instance, the Ethiopian nomads were empowered to acquire functional literacy through NFE. Much of the learning was aligned with their herding practice by including topics that improve the quality of livestock in order to make them better herders. Similar studies conducted in Lesotho revealed the willingness of the herders to learn about technology. Ethiopia also developed a hybrid curriculum that integrated the elements of indigenous ways of knowing into their conventional education in order to develop a relevant programme for the Maasai nomads. The assumption was to bring about a significant change in the lives of the Maasai community. Therefore, Lesotho's NFE provision may want to tap into Ethiopia's experience and see how best to customise the findings to Lesotho's herding context.

Along the same lines of making NFE relevant to the local context, Nigeria modified the mainstream education curriculum in such a way that it incorporated horticulture and animal husbandry. This initiative did not only move NFE beyond basic literacy and numeracy. But it also focussed on what the herders were passionate about as a strategy to make learning more appealing and relevant to the herders (Kratli, 2001). Given the high dropout rates of Basotho herders from the formal school and also taking into consideration their concern on the need for herder inclusion in curriculum design, Lesotho may consider adopting Nigeria's approach to herding NFE provision.

In Ethiopia, however, emphasis was on bringing about a significant change in the lives of the nomads (Krätli, 2001). In other words, education was seen as a mechanism that transforms the strong-held beliefs and attitudes of the Maasai by introducing them to know forms of knowledge that was relevant to their herding practice. Therefore, the programmers integrated the traditional knowledge within the modern one. Thereafter, the Maasai were

trained on the new system with the impression that they would be able to apply the new knowledge to their various real life herding challenges. Indeed the newly acquired skills were integrated into the herding career but it also enabled the Maasai to integrate back into their communities as change agents who catalysed a positive change.

The take home message from this case studies is a need for a flexible and inclusive curriculum praxis that extends beyond the traditional basic literacy into new ways of living for empowering the herders socially and economically. In so doing, the herders will gradually move out of their marginalised state (Pitikoe, 2017).

In another case study that came from the South African University of Pretoria, the university used the mobile devises application of messaging system as a learning tool in its distance learning programme. The approach based itself on the popularity of mobile devices to both the students and the lecturers. The success of the program was seen both in the improvement of the learner performance as well as the immediate feedback provision. The programme also owed its success to the fact that the messaging system was less costly and also familiar to the students. Given the high rates of poverty in Lesotho and the rugged topography, the messaging system could be applicable in Lesotho's context.

What the herders can benefit from digital NFE

It was also discovered that in as much as herders fall on the margins when it comes to service delivery and access, they however, own the mobile devices in the form of cellular phone. However, not much has been done to explore the feasibility of using these devices as tools that can facilitate teaching and learning of programmes that target Basotho herders.

Additionally, while Lesotho recognises a need for good quality and equally accessible education provision Basotho males' access to education is crippled by the semi-nomadic nature of their job and the inaccessible topography. This implies a need to device teaching and learning programmes that would reach out to the herders at the places and times that were convenient to them.

Identified shortfalls

Among the glaring challenges that emerged from the literature is the poor ICT infrastructure of Lesotho which can potentially hamper an effective roll-out of the national digital learning.

Equally important is the fact that change comes at a cost. Given the current level of poverty in Lesotho, coupled with political instability, the commitment of funding and other relevant resources that would enable a smooth implementation of the digitally-supported learning in Lesotho seems remote at the moment.

It is also important to note the commitment that the national ICT policy made to train Basotho on ICT which never saw the light of the day since its conception in 2005. This policy limitation further affects the wider strategic decision-making and strategic direction with regard to implementing the technology mediated learning. The available literature also emphasized a need for education provision targeting the herders to be able to liberate the herders from poverty and unemployment.

CONCLUSION

This paper examines how NFE for herders is provided in other countries. It also reviewed some programs where technology was used to facilitate teaching and learning activities. Based on these findings the paper will suggest ways which Lesotho's NFE programmes can integrate technology in a bid to widen access to education. The findings presented in this chapter were reached through a review of literature.

The 21st century has turned the world into a global village, where collaboration and communication are made easier by using the digital tools. Most of these tools come with applications and technology platforms that allow real time communication and feedback provision. It was also found out that the convenient nature of technology has made education accessible anywhere and anytime of the learners' choice.

Lesotho like other countries elsewhere in the world has subscribed to the need for digital learning. For instance, despite her poor ICT infrastructure, Lesotho developed and adopted an ICT policy in 2005, whose intent was to widen access to ICT tools and technology nationwide while also supporting technology-mediated distance learning. However, not much progress has been reported in this area. Some of the challenges that Lesotho faces include the underdeveloped ICT infrastructure which results in a sporadic network coverage. On a positive note, it was also uncovered that most Basotho own mobile devices such as cellular phones so much that even the most marginal groups of herders own cellular phones. This can present a ray of hope, which Lesotho may want to explore for future integration of social media in distance learning.

Some of the reasons that can account to the delayed implementation of social learning include the limited government support to NFE activities because Lesotho does not have a ratified policy that supports the implementation of distance and NFE activities. Also, not much research has been done that can inform the policy and practice on the necessary change and how such change can be implemented. Currently, the limited ICT resource base in Lesotho does not place the country in a good space for adequate provision of learner-support.

The paper makes the following suggestions. First is the need for Lesotho to explore how herders can engage and learn using the cellular phones. Secondly, the design of the teaching and learning activities that target the herders has to include the herders' voice each step of the way in order to accommodate their herding needs and culture. Thirdly, Lesotho may want to explore the use of mobile devices as in the case of UP and take advantage of the messaging system application which is already less costly and does not require any installation costs. Equally important is the affordability of sending and receiving messages. Given the poor ICT infrastructure and the rugged topography, which may hamper communication, the short messaging system has survived the test of time and has become the most reliable mode of communication for Basotho herders, whose semi-nomadic career is mainly practiced in hard to reach areas of Lesotho.

REFERENCES

Benson, R. & Samarawickrema, G., (2009). Addressing the context of e-learning: using transactional distance theory to inform design. *Distance Education*, 30(1). 5 − 21.

Carlsen, A., Holmberg, C., Neghina, C. & Owusu-Boampong, A. Closing the Gap Learners' Opportunities for distance education to benefit adult learners in higher education. Hamburg: UNESCO Institute for Lifelong Learning (UIL).

Dalton, E.M., Mckenzie, J.A. & Kahonde, C. (2012). The implementation of IE in South Africa: Reflections arising from a workshop for teachers and therapists to introduce Universal Design for Learning. *African Journal of Disability,* 1(1), 1-7.

Dladla, N. (2017). Racism and the Marginality of African Philosophy in South. 18: 204-231.

Dunleavy, M., Dede, C. & Mitchell, R. (2009). Affordances and Limitations of Immersive Participatory Augmented Reality Simulations for Teaching and Learning. *Journal of Scientific Education and Technology,* 18, 7 –22.

Gikas, J. & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *Internet and Higher Education*, 19, 18–26.

GOL. (2000). *Vision 2020: National Vision for Lesotho.* Maser: Government Printers.

Goscilo, H. & Hashamova, Y. (2010). Women in War: Mobilisation, Manipulation, and Marginalisation on the Eastern Front. *Aspasia*, 4, 97–102.

Hanover Research. (2011). Distance education models and best practices. http://www.hanoverresearch.com. Accessed on June 26, 2018.

Helgesson, M., Tinghög, P., Niederkrotenthaler, T., Saboonchi, F. & Mittendorfer-Rutz E. (2017). Labour-market marginalisation after mental disorders among young natives and immigrants living in Sweden. *BMC Public Health*, 17(593), 1 -12.

Hylén, J. (2015). *Mobile learning and social media in adult learning. Literature review prepared for the ET Working Group on Adult Learning.* Brussels: European Commission

Kingdom of Lesotho. (1993). *Constitution of Lesotho.* Maseru: Government Printers.

Kassandrinou, A., Angelaki, C., & Mavroidis, I. (2014).Transactional distance among Open University students: How does it affect the learning process? *European Journal of Open, Distance and e-Learning,* 17(1), 26 – 42.

Krätli, S. *Education Provision for Nomadic Pastoralists, A Literature Review. IDS Working Paper 126.* London: Institute of Development Studies Brighton.

Lekhetho, M. (2013). Stakeholder Perspectives on Strategies that can Improve Student Performance in the School-Leaving Examinations in Lesotho. *Mediterranean Journal of Social Sciences*, 4(3), 85 – 95.

Ministry of Communications, Science and Technology. (2005). Lesotho ICT Policy. http://www.lesotho.gov.ls. Accessed on September 16, 2016.

MoET. (2005). *Unpublished Lesotho Education Sector Strategic Plan 2005-2015.* Maseru: Government Printing.

MoET. (2008). *Unpublished Lesotho Open and Distance Learning Policy: Final Draft.* Maseru: Ministry of Education and Training.

Mosia, P. A. (2014). Threats to inclusive education in Lesotho: An overview of policy and implementation challenges. *Africa Education Revie*, 11(3), 292-310.

Osborne, D., Cutter, A. & Ullah, F. (2015). *Universal Sustainable Development Goals: Understanding the transformational challenge for developed countries*. https://www.stakeholderforum.org. Accessed on July 01, 2015.

Perraton, H. (2007).Open and Distance Education in the developing world, 2nd edition. London: Routledge.

Pitikoe, S. (2017). Basotho herders learn through culture and social interaction. *Learning Culture and Social Interaction*, 13, 104-112.

Pittenger, A. L. (2013). Instructional design and assessment: The use of social networking to improve the quality of interprofessional education. *American Journal of Pharmaceutical Education*, 77(8), 1 – 9.

Pratt, Y. P., Louie, D. W., Hanson, A. J. & Ottmann, J. (2018). Indigenous education and decolonization.

Siyaciwena, R. (2000). *Case studies of non-formal education by distance and open learning*. London: Commonwealth of learning.

UNDP. (2012). *Africa Human Development Report: Towards a Food Secure Future*. New York: United Nations Development Programme.

UNESCO. (1985). *Linking formal to non-formal education: Implications for teacher training*. Paris: UNESCO.

Vaičiūnienė,V., Romeris, M. & Mažeikienė, V. (2012). Social media in adult education: Insights gained from Grundtvig learning partnership project "institutional strategies targeting the uptake of social networking in adult education (ISTUS)". *Social Technologies*, 2(2), 473-482.

Van Wyk, M. (2014). Using social media in an Open Distance Learning teaching practice course. *Mediterranean Journal of Social Sciences*, 5(4), 370 – 377.

Zeelen, J., van der Linden, J., Nampota, D. & Ngabirano, M. (2010). *The burden of educational exclusion:Understanding and challenging early school leaving in Africa*. Rotterdam: Sense Publishers.