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Preface

The rapid advancement of technology in all spheres of human activity over the last few decades has brought with it sweeping changes in our approach to every issue of life, including teaching and learning. The ways in which 21st century learners tackle problems create a drastically different picture from the ways in which learners of past centuries approached problems.

The reality of the evolving educational landscape of the 21st century calls for academics, researchers, policymakers and designers of educational technologies to regularly collaborate and share ideas in order to learn from each other and be able to enact policies, develop, adopt and support the use of technologies that will empower the 21st century learners.

The South Africa International Conference on Educational Technologies (SAICET) is a scientific conference that offers a platform for policymakers, academics and researchers across the world to network and presents a wide range of perspectives to address issues relating to educational technologies.

This is the second edition of the conference. In the first edition in 2015, 76 papers were presented by participants from 12 countries. The presentations and deliberations were very insightful and thought provoking. At this year's conference, 79 proposals have been received from participants from 14 countries. This is a further testimonial to the wide range of the nature and contexts of the presentations and the crossbreeding of ideas at the conference.

We welcome all participants to Pretoria and especially the international participants who may be visiting Africa for the first time. We are most delighted to have all of you here to participate in the conference. SAICET will continue to be an annual event, so we look forward to seeing you and many other participants next year at SAICET 2017.

We specially thank the keynote speaker, the reviewers of the full papers and the editors of proceedings who have worked tirelessly to make the conference a success.

Prof. A. Mji

Conference Chair

List of Reviewers

The organising committee of SAICET 2016 would like to greatly thank the following reviewers who meticulously reviewed the conference papers.

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Review Process

In total, 79 manuscripts in different areas within the field of Educational technology were received. Of these manuscripts, 38 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 20 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 25 authors with suggestions of what needed to be addressed. After receiving the re-worked manuscripts, the editorial committee finally accepted 23 for inclusion in the proceedings. This means that the acceptance rate was just about 61%.

Editors

U. I. Ogbonnaya
S. Simelane-Mnisi

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RE-EXAMINING FACTORS INFLUENCING TEACHERS' ADOPTION AND USE OF TECHNOLOGY AS A PEDAGOGICAL TOOL

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Abstract

The aim of this study is to ascertain factors that influenced teachers' adoption and use of technology for teaching. The significance of the study is that school stakeholders will be able to determine which factors are significant to encourage more in-service teachers to adopt and perhaps use technology as a pedagogical tool. Davis' (1989) Technological Acceptance Model (TAM) was adopted as a theoretical framework for this study. According to Davis, users would accept a technology if it is perceived to be both useful and easy to use. The model was adopted and modified to explain why teachers in this study have adopted and perhaps using technology as a pedagogical tool. This is a qualitative study in which ten teachers were interviewed. Data was analysed inductively and deductively and the result showed that the most significant internal factor that influenced teachers to use technology was the benefits of technology for teaching and learning and external factors were availability and accessibility of technology in schools. The finding has provided significant data for school stakeholders who want to encourage more teachers to adopt and use technology as a pedagogical tool.

Keywords: Technology Acceptance Model, Technology adoption, Technology uptake, Technology use

1.   Introduction

The rapid growth in Information and Communication Technology (ICT) has brought remarkable changes in the 21st century (Nyambane & Mzuki, 2014). According to Prensky (2005), two thirds of the people on the planet have a cell phone. With this widespread use of technology, teachers are pressured to adopt and use technology for teaching. In South Africa (SA), teachers have been encouraged to use technology for curriculum delivery. The government has deployed technological tools at schools and trained teachers in the use of these tools. For example, the Western Cape Department of Education introduced the Khanya Project in 2001with the aim "to promote learning and maximise educators' capacity to use appropriate, available and affordable technology during curriculum delivery" (du Toit, 2005:1). By 2007, 76% of schools in the Western Cape were equipped with computer laboratories (Isaacs, 2007 cited in Sherman & Howard, 2012). In another project, 'one laptop per child', the MEC (Member of the Executive Council) of Gauteng province in South Africa provided some schools with tablet phones and smart boards (Makhubu, 2014). Despite the SA government expenditure on technological equipment, there seems to be a slow rate of adoption and use of technology in the classroom. The aim of this study is to ascertain factors that influenced teachers' adoption and use of technology for teaching. This study is significant as school stakeholders will be able to determine which factors are important to encourage more in-service teachers to adopt and perhaps use technology for pedagogical

purposes. The research question guiding this study is: what factors influence in-service teachers' adoption and use of technology as a pedagogical tool.

2. Literature review and theoretical framework

Numerous studies (Gilakjani, 2013; Cubukcuoglu, 2013; Godoe, Obegi & Macharia, 2014; Blackwell, Lauricella & Wartella, 2014; Buckenmeyer, 2010; Kumar, Rose & D'Silva, 2008; Chen & Reimer, 2009; Mai & Hong, 2014) have acknowledged factors that may influence teachers' adoption and use of technology for teaching. These studies found teaching experience, self-efficacy, availability and accessibility to technology, professional development training on technology, teachers attitude, availability of internet, maintenance of ICTs infrastructure, teachers workload, teacher gender, teachers' age, presence of ICT policy, adequacy of funds, confidence, technology is easy to use, computer compatibility and attitude, teachers pedagogical beliefs and school culture as factors that influenced teachers use of technology.

With the aim of understanding factors that influenced in-service teachers' adoption and perhaps use of technology, the Technology Acceptance Model of Davis (1989) was adopted. This model was used to understand users' acceptance and actual use of a technology. Davis focused on two components: "perceived usefulness" and "ease-of-use". Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance", while "ease-of-use" is "the degree to which a person believes that using a particular system would be free from effort". The two constructs may account for teachers' acceptance and possibly use of a technology. However, the model is limited. This study modified TAM model in an educational context. The model shows how teachers' 'actual use of technology' was influenced by attitude and behavioural intention which in turn was influenced by external and internal factors (see section 4)

3.   Methodology

A qualitative approach was used to collect data in which teachers' were interviewed one-on-one regarding their perceptions of factors that influenced them to use technology as a pedagogical tool. A qualitative approach gave in-depth data that answered the research question.

The sample consists of Intermediate Senior Phase (ISP) teachers from schools in Cape Town. All Intermediate Senior Phase teachers who graduated at a teacher education institution in 2013 were invited to take part in this study. This means that all teachers who graduated in 2013 had an equal opportunity to participate in this study. These teachers were invited because it was convenient for the researcher to obtain their contact details since she is a student at the university. The teachers' contact details were obtained from the university database with the explanation that all information would be used solely for research purposes. These teachers were contacted telephonically and through emails. Only ten teachers voluntarily accepted to be part of this study.

An open ended interview schedule was used to collect data. The use of one-on-one interview as a source of data collection was to gain deeper understanding of factors that influenced in-service teachers' adoption and perhaps use of technology for teaching.

The one-on-one interviews were audio recorded and data transcribed. Data were analysed inductively and deductively whereby themes were obtained from the literature and new themes were generated. All themes generated from the transcribed data aid in answering the research question.

Permission to do research was granted by the University Ethics Committee and the Western Cape Department of Education. Also, consent was sort from all participants in this study and they signed an informed consent form. According to (Kumar, 2005:212), it is unethical to collect data without the knowledge of participants, and their expressed willingness and informed consent.

4.   Result

From the analysis of the one-on-one interviews, it was evident that two constructs of the Technology Acceptance Model (Davis, 1989), "perceived usefulness" and "ease of use", influenced in-service teachers to use technology in their teaching. However, other factors were found to have influenced teachers' adoption and use of technology. These factors have been classified into external and internal factors. According to the researchers, externally related-factors are extrinsically motivated. These are factors within the teachers' environment that influence them to use technology, while internal factors came from within the teachers.

External factors are: availability and accessibility of technology at schools, availability of technical support, pre-service training, support from school stakeholders (principal, colleagues, family and knowledgeable learners), and professional development training. Internal factors are: technology is easy to use, socio-economic status of learners, pressure to use technology, experience with technology, and benefits of technology.

The researchers started by discussing external factors that influenced teachers' use of technology for teaching. In each theme highlighted, only the most significant comment has been reported.
The teachers will be referred to as Teachers 1, 2, 3 up to Teacher 10.

4.1 External variables
Availability and accessibility of technology at school
One of the most important factors mentioned by the in-service teachers, and confirmed by literature, that influenced technology use was both availability and accessibility to technology (Goyal, Purohit & Bhagat, 2010; Ahadiat, 2005; Ertmer, Ottenbreit-Leftwich & York, 2007; Martin, Parker & Oyarzun, 2013). An example of availability and accessibility of technology influencing teachers' use of technology is found in the study by Martin et al. (2013). Teachers had Wimba, a virtual tool, which was available for faculty to experiment with, and they could use it without having to pay any extra cost. It was reported that there were no restrictions on the number of computer rooms that each faculty could use, how long they could use Wimba or how many people could log in at the same time.

From the data analysis, the use of technology for teaching seemed to be linked to availability and accessibility of equipment in the school. Teachers reported that availability of hardware was an important enabling factor for technology use. Without technological hardware being present at the schools, it would have been difficult for them to use technology for teaching

and learning. The teachers commented as follows: Teacher 1 indicated "… We have desktop computers that I used but the only thing is that they were old". Teacher 2 reported "I have a smart board in my class. I have a laptop, computer in my class … we subscribed to Evalue-net [Educational software program]".

Availability of technical support
Technical support in schools is important to encourage teachers' use of technology for teaching. ChanLin, Hong, Horng, Chang & Chu (2006) note that it is a natural phenomenon that teachers worry about their ability to overcome possible technical problems and to handle technology effectively, which, in turn, makes them feel insecure and reluctant to use technology for teaching. Therefore, with no technical assistance, teachers may be reluctant to teach using technology. A typical example is seen when one teacher was concerned about handling unexpected breakdowns of the computer and still had to attend to learners' behaviour in her class (Chen & Reimer, 2009).

The finding in this study confirmed the literature. There was a general feeling amongst two participants (Teacher 2 and 4) that the technical assistants they had in the schools were reliable. They responded swiftly to technically related queries without teachers losing instruction time. These technical assistants were permanent employees who worked normal school hours from 8:00 am to 15:00pm from Mondays to Fridays. Teacher 2 remarked, "… sometimes I taught and there was a problem … since the technical assistant was always on the school premises [he's got an office, he is a full-time employee), he would fix the technical problem with an insignificant loss of my teaching time. His promptness in responding to queries also motivated me". Arguing along the same lines, Teacher 4 pointed "Our IT guy is reliable; he comes in the morning and leaves at the end of the day. So he is always there to help and he responds to technology-related queries very fast …".

Pre-service training
Pre-service training is an important platform for training future teachers on how to teach with technology. Liu (2011) and Bingimlas (2009) noted that teacher education institutes are natural places for instilling pre-service teachers with technological skills. Empirical evidence shows pre-service training encourages teachers to use technology as it boosts their confidence (Mathipa & Mukhari, 2014).

In this study, Teacher 1 and 10 experiences with projects during pre-service training influenced them to use technology for teaching. The lecturers gave them projects that required them to research for information. By searching for information to complete their projects, they gained technological skills. Teacher 1 reported: "… in our fourth year, especially with the project that we did on a digital story that equipped me. It added onto what I already know about technology". Like Teacher 1, Teacher 10 indicated: "The digital storytelling project on campus was great … it [digital storytelling] built my confidence to use technology. I learned so much stuff – how to use the photo story software, Microsoft Word and editing software … yes, the project was good" **(Teacher 10, interview).**

One teacher reported that her experiences with mentor-teachers during teaching practice influenced her to use technology. She was fortunate to be in schools which mentor-teachers used technology for teaching. As a result Teacher 6 learned how to use technology for pedagogical purposes. She explained "… and if there was one school that I went to, where I

had the opportunity to use it [technology] in the classroom during teaching practice, it was a special needs school. They had children with cerebral palsy. The teacher [mentor teacher] taught with the smart board and I learned how to use the smart board from her".

Support from school principal

Researchers such as Goyal et al. (2010) indicated that providing encouragement to teachers, perhaps by the principal, encouraged teachers to frequently use technology for teaching. In some cases, in this current study, teachers reported that positive remarks from principals influenced them to use technology. For example, Teacher 7 indicated that he used technology because of positive remarks from the principal. He was from a no-fee-paying school (quintile 1) where they lacked technological resources. Despite challenges faced, he taught with his personal technological equipment. Teacher 7 commented:

> My principal studied long time ago, like they wrote on slates and stuff like that. But now it is different times because teachers are using technology in their teaching. The principal knows technology is important for teaching and learning. She is impressed and she said during staff meetings … she made some positive remark: 'Teacher 7', I know you are doing great with the children in your class, keep it up' (**Teacher** 7**, interview).**

Support from colleagues

Teachers are members of learning communities, they learn best from each other (Eze & Olusolaadu, 2013). Studies such as Espino (2012), and Mai and Hong, (2014) reported that support from colleagues influenced teachers to use technology for teaching. In the ChanLin et al. (2006) study, some teachers felt that they were lucky to have colleagues to work with who encouraged them to use technology. Due to the importance of support from colleagues, Lau and Sim (2008) suggest that there is a need to have a centralised database or ICT network for teachers to facilitate sharing of materials and to post important announcement.

It appeared that out of goodwill, colleagues at schools had organised workshop to assist with technology training. These workshops created a unique relationship between teachers as they could ask each other for assistance after training. On this point, Teacher 5 commented: "We have a teacher in our school, she is really … very experienced with technology, she kind of voluntarily runs workshop … she is kind of the head of the punk kiddos [excellent in technology] at the school compared to other teachers, if I can say that. These workshops had developed relationships between teachers as they could support each other even after training [session]".

Support from family

ChanLin et al. (2006) found that support from family members influenced teachers' use of technology for teaching. It emerged that one of the factors that influenced teachers to adopt and use technology was family support. Teacher 8 reported that family members were always willing to contribute ideas on how to use a specific technology and also willing to share family technology equipment with the school. Teacher 8 reported: "Yes the family had just one laptop. My son and I use it since he is in Grade 12 and had to do assignments, but sometimes he sacrificed for me to bring it to school and teach with it (Teacher 8, interview). She continued:

My son and I usually discuss how technology fits in a lesson, how best I could use it. He has been of great help … my son helped me to create PowerPoint lessons because he is very good. He is more advanced than me, so you see …

Support from knowledgeable learners
The majority of teachers indicated that they do not need learners to motivate them to use technology; however, a few teachers had support from learners. Learners assisted teachers in setting up technological equipment and also assisted peers in the computer laboratory. In contrast, Ale and Chib (2011) argued that teachers do not always give learners the platform to take responsibility for their learning because they want to enforce their authority.

Teacher 6 used her own projector and laptop because the school lacked resources. Learners assisted her to connect the projector, laptop, cables and plugs. This was important as there was little loss of instructional time as setting up technological equipment took less time. She narrated:
"My learners are good with technology, immediately I took out my equipment out from my bag; they want to help me set up. I allowed them to do that, so within a few minutes we are done setting up".

Professional development training
Cubukcuoglu (2013) found adequate professional training in the use of ICT as an enabling factor for technology use. In the Espino (2012) study, teachers who attended professional development training complained of contextual factors preventing them from using technology in their teaching. This may mean that after professional development training teachers may use technology for teaching if contextual factors are put in place by the school. According to Hakverdi, Dana and Swain (2011), the more teachers attend technological training, the greater is the likelihood for them to adopt and use it during curriculum delivery. Therefore, exposure to professional development training will influence teachers to use technology in their teaching.

Discussing professional development training, Teachers 1 and 4 noted that professional development training intensified their inner drive to integrate technology during teaching. Teacher 1 commented: "We had training on how to use technology, we have been on smart board and many software training [sessions]. With that kind of exposure, there was this drive to integrate technology in my teaching". According to Teacher 4, "… the school always sent us on professional development training … they [the school] always arranged things like that [training], so I felt this pressure". To this end, Lau and Sim (2008) suggest that training should be offered to teachers on a continuous, rather than one-off training. Continuous training may enhance teachers' competence in technology, thus encourage them to use technology.

4.2. Internal factors
Technology is easy to use
Martin et al. (2013) found that teachers used technology because it was easy to use. The teachers used Wimba, a virtual tool for teaching and learning, because they were able to use it with minimal training. On the other hand, some participants in Mai and Hong (2014) used technology because it reduced their workload. Kumar et al. (2008) found 'eased of use' as the strongest factor to influence technology use.

Teacher 2and 4 agreed that they integrated technology into their pedagogy because it eased their teaching workload. Instead of going to the library and reading books which wasted a lot of time, they used the internet which was faster and took less effort to create a technological lesson. Teachers reported:

> Technology alleviated the burden of marking, the administrative burden, particularly the marking burden, is quite weighty … I use technology because it relieved me of the burden of marking **(Teacher 2, interview).**

> I used technology because it is less stressful for me to create a lesson. Firstly, I know how to use a smart board and I downloaded stuff from the internet and showed it to them [learners] … it is just less stressful using the internet to prepare lessons than going to the library to get materials **(Teacher 4, interview).**

Davis (1989) and Rogers (1995) indicated that an individual could adopt and use technology if the features are not complex. Some teachers in this study used technology because the features were easy to use. Terms such as *"drag and drop activities", "I would just flash games", "I flip back to the page and then saved it"* were used to describe how easy it was to use certain technology.

Socio-economic status of learners

In Blackwell, Lauricella and Wartella (2014) study, student socio-economic status had strongest effect on teachers' attitude to use technology. In this study, the low level of socio-economic status of learners encouraged teachers to adopt and use technology as a pedagogical tool. The reason they taught with technology was to introduce learners to it since they had no exposure at home. Besides, learners would need technology to be able to communicate and function well in today's society, which is technology-driven. The teachers reported:

> My school is not in a very well-to-do community. It is a previously disadvantaged community, so many of the learners do not have technology at home, they are not used to technology. So I incorporated technology into my lesson, just to give them that exposure **(Teacher 3, interview).**

On the contrary, teachers who taught in working class communities were encouraged to use technology. The reason was that parents had technological resources at home and they assisted learners with technology-related tasks. Teacher 2 reported that:

> … I think probably experience and the cultural context of the school, middle-class, I suppose. We have to use it that is what the parents paid for … it's almost prescribed here. It makes my work easier and when I gave them work to do, I know they have the resources [technology] at home and their parents are knowledgeable to assist

Pressure to use technology

Chen and Reimer (2009), Mai and Hong (2014) and ChanLin et al. (2006) reported that teachers used technology because it is a universal trend. Korean and United States teachers were integrating technology in their teaching because they did not want to be seen as old-

fashioned (Park, 2009). It was further stated that teachers were encouraged to use IT in every field to catch up with the social change caused by IT. Similarly in Kumar et al.'s (2008:1131) study, secondary school teachers used technology because they wanted to be seen by their colleagues as 'up-to-date with their teaching methodology'. Therefore, teachers used technology because it gave them prestige (Cox, Preston & Cox, 1999).

From teachers' responses, it could be deduced that in education there is a shift from the traditional style of teaching to the use of technology for teaching and learning. As a result, teachers felt pressured as their colleagues used technology for teaching. Without integrating technology in their lessons, it would have appeared that they were not part of the 21st-century movement where everything is technology-driven. According to Teacher 1, "South Africa is growing technologically – most classrooms are paperless. Not knowing how to use technology for teaching would have been a disaster, you know …". Teacher 5 added, "It's a movement in my school – all the teachers in my school use technology and I do not want to be the only one not using it … I mean, we have most of the technological equipment." Martin et al. (2013) reported that teachers used technology because of peer pressure, while Ahadiat (2005) agreed that teachers used technology because colleagues were using it frequently for teaching. Lambic (2014) focused on pre-service teachers and found that they would use technology because they wanted to be respected by their colleagues since perhaps technology is a trend and colleagues are using it for teaching

Experience with using technology
Experiences with technology in the context of this study refer to informal training acquired that influenced teachers to adopt and use technology for teaching. Kahveci (2011), and Cox et al. (2000) reported that teachers owning personal technological equipment is an enabler for using technology for teaching. Owning personal technological equipment would give teachers the opportunity to experiment with technology, thus increase their competency level. Bingimlas (2009:242) confirmed that having access to ICT resources can help teachers increase their competence whether by 'self-training through the internet or by communication with experts'. A teacher in the current study reported:

> Yes, having my own laptop influenced me to use technology. If I didn't have it [technology], it would have been terrible. I got my confidence from using my laptop at home and I practised how to do things every time **(Teacher 6, interview).**

Technology is beneficial for teaching and learning
There was a general feeling that teachers used technology because it was beneficial to teaching and learning. To this end, three teachers commented that instead of copying notes on a chalk board which wasted a lot of time, they prepared lessons at home with their laptop and taught using smart board. Thus, teachers had enough time to interact with learners during a lesson. Similarly, Shamim, Aktaruzzaman and Clement (2011) indicated that teachers used technology because it was easier to prepare and teach with technology. In a study, 95% of teachers confirmed that they use technology because it improves presentation of materials (Cox, Preston & Cox, 1999).

On this issue, two teachers reported:

It was easier for me to type things out than write things on the chalk board. I had enough time making sure that children [learners] were working. I walked around and assisted learners **(Teacher 2, interview)**.

I think about when I was at school, my teacher would say, 'OK, now you have to write down these notes', and he would spend ten minutes just writing it down on the chalk board. And now I just put in my flash and double-clicked, and the notes would be up **(Teacher 4, interview)**.

5. Conclusion

This study has extended the TAM theoretical framework in an educational context. However, this study found that family support and teachers owning their personal technology equipment, even though not emphasised in the literature, are significant to encourage technology adoption and use in the classroom.

From the data, it could be deduced that even when technology is difficult to use or there is lack of resources, teachers may integrate technology into their teaching if it eases their teaching tasks. All teachers unanimously agreed that they used technology because it was beneficial to teaching and learning. Perceived usefulness was the most significant internal factors that influenced teachers to use technology while availability and accessibility of technology was the most significant external factor.

Due to the small size of the sample, the findings cannot be generalised since the study is limited to few ISP in-service teachers. However, it has provided valuable insights into the body of research on factors that influence teachers to use technology. A more comprehensive sample is needed for generalizability. It would be interesting to do a longitudinal study to ascertain factors that influence teachers frequently or sustain use of technology for teaching. Based on the finding, the researchers recommended that: Teacher education institutions must train teachers holistically by targeting their technological, pedagogical and content knowledge. Acquiring TPACK may boost teachers' confidence to use technology and expose teachers to the benefits of using technology as a pedagogical tool.

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EVALUATING E-LEARNING READINESS AND EFFECTIVENESS AT A PARASTATAL

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Abstract

Increased time pressure, coupled with the drive for cost reduction, has seen a large number of organisations opting for electronic learning as an important delivery mechanism for workplace training. This article aims at discussing the range of dimensions related to achieving learning outcomes through e-learning at a South African parastatal. The major contribution of this study was to develop frameworks of evaluating two key factors of e-learning effectiveness; namely organisational readiness as well as post-implementation outcomes evaluation. Qualitative and quantitative methods were used to collect data from a sample size of 180 employees in the organisational unit. Twenty-six online survey responses were obtained, as well as twelve semi-structured interviews were completed. Triangulation of the findings was completed through analysing the survey responses, interviews narratives and statistical analysis. Results indicated that organisational readiness factors such as leadership, content development, and pre-evaluation, have a significant impact on employees meeting learning outcomes through e-learning. Recommendations based on the findings are made for process changes to be made within the parastatal. The conclusions drawn from this study are aimed to aid organisations that wish to apply the frameworks proposed in this study, to evaluate their own e-learning programmes, both prior and post e-learning implementation.

Keywords: e-Learning, e-learning readiness evaluation, e-learning outcomes evaluation, e-learning effectiveness, e-learning system design framework

Introduction

Training and skills transfer is vital in any organisation that seeks improved performance, competitive advantage and continuous improvement. Khirallah (2000) and Evans (2000) suggest that demands placed on today's workforce and time pressures, coupled with the drive for cost reduction, have seen a large number of organisations opting for electronic learning (e-learning) as an important training mechanism. The term e-learning has numerous definitions in literature, for the purposes of this paper, a definition has been coined for e-learning as; learning that can be achieved over any electronic media, where the learner is in control of when to learn, how long to learn, and where to learn from. In light of the pressures on cost and time, Khirallah (2000) indicates that e-learning is a preferred learning avenue in organisations as it has the potential to reduce or eliminate workplace learning travelling related expenditure. Khirallah (2000) furthermore lists additional benefits to e-learning as that it can save approximately 50% in training time, it can cut classroom based training costs between 40% and 60%, it is environmentally friendly as it eliminates the need for printing manuals, it provides flexible training times and it has the potential to improve employee retention. Despite its potential, e-learning may not always deliver on expectations; one of the reasons is that organisations may not have specific methods of evaluating how effective e-learning has been for them. Woodhill (2004) for instance, suggests that the failure of e-learning can largely be attributed to issues in the initial design, the development, and the

implementation of e-learning in an organisation. These factors can be attributed to a lack of evaluation of the readiness of an organisation to take on e-learning. It is, therefore, important for a post-implementation evaluation of the effectiveness (outcomes evaluation) to be done to determine whether e-learning has succeeded or failed for the organisation, and how this can be improved.

Problem Statement
The frameworks that exist in the literature focus mainly on academic institutions and any e-learning frameworks related to organisations that exist in the literature, are highly discipline based. The literature reviewed provided little guidance regarding suggesting a generic e-learning readiness or effectiveness framework at an organisational level. Organisations that wish to implement e-learning thus have no reference from literature, or generic framework, that they can employ.

Objective
The objective of this study was to evaluate how an organisation can evaluate, prior to implementation, whether e-learning will be suitable for their organisation. The second objective was to evaluate how effective e-learning has been in meeting learning outcomes.
The contribution of this paper is thus to propose frameworks that may potentially be utilised at an organisational level to assess organisational readiness, and to evaluate whether learning outcomes were met post-implementation and utilisation. This article aims at discussing the range of dimensions related to achieving learning outcomes through e-learning.

Conceptual Frameworks
Existing readiness and post implementation evaluation frameworks of e-learning, some of which can be seen in Table 1, have either been developed for academic settings, or are discipline based. Vaughan (2008, p 9) states that academic learning is largely theoretical and abstract, where the intention is to shape learners into a specific type of thinking for their chosen discipline, for example, teaching engineering students to think logically and analytically. Workplace learning, on the other hand, is often aimed at more practical, experiential, and work-related learning outcomes. For this reason, a researcher could not come across any existing frameworks in the literature that could be directly implemented in the context of this study; a workplace organisation. This led to the development of frameworks that could better suit workplace organisations.

In order to construct frameworks for this study, four existing e-learning readiness frameworks proposed by Okinda (2013), Alshaher (2013), Chapnick (2000) and Mercado (2008), together with three existing e-learning effectiveness frameworks proposed by Ruggeri, Farrington and Brayne (2013); Aguti, Walters and Wills (2013) and Vivekananthamoorthy and Sarukesi (2012) were reviewed. Although these frameworks were designed for either academic settings or specific disciplines, such as healthcare, these frameworks proved to be a good departure point for this study, as a range of foundational principles were found to be consistent amongst these frameworks.

The frameworks for academic institutions place emphasis on the responsibility of instructors that facilitate the online course. In an organisational setting, however, there is often no e-learning instructor, as learning is generally on-demand and is initiated by the employee. Table 1 outlines the main points of each framework from the literature, as well as some of the

identified shortcomings with the existing frameworks in literature, which were addressed in this study for developing generic frameworks for organisations.

Table 1: Review of frameworks from literature

Frame-work reviewed	Main points/benefits	Shortcomings
Readiness framework		
Okinda (2013)	• Dimensions relate to the users of the system, the enabling technology, the organisational culture, and the environment. • Simple five-dimension framework that can be expanded – good theory building opportunity with this framework	• Dimensions related to budget/funding availability not covered. • An e-learning index is the outcome, however, no index to benchmark against
Alshaher (2013)	• Multidimensional framework approach • Contains seven dimensions that are structured into hard and soft elements • Each of the seven dimensions offers an exhaustive coverage of items to be assessed • Shared values are emphasised as the binding glue of the other dimensions	• Emphasis is not placed on the individual learner's attitude towards e-learning – this can be critical as e-learning is highly individual based • Highly exhaustive list of elements to be assessed
Chapnick (2000)	• Eight-dimensional framework • One of the only frameworks that considers sociological readiness as important to be assessed • Emphasis is placed on the learner's locus of control by the psychological readiness dimension	• Despite having eight dimensions, organisational culture is not assessed • Individual components under each dimension that needs assessment are not mentioned
Mercado (2008)	• Built on Chapnick's model, a simplified five-dimensional framework is proposed • Much emphasis is based on the learner's computer and software tools skills • Provides a detailed list of items to be assessed that can be readily deployed as a survey	• An individual's computer skills can vary from individual to individual; in an organisation the size of Eskom, individual assessment is not feasible • Highly instructor-learner based; applicability to organisations is limited • No emphasis placed on content development
• **Effectiveness frameworks**		
Ruggeri, Farrington and Brayne (2013)	• Readiness factors are featured into the effectiveness framework • Framework is sustainable and open for improvements • Course outcomes are assessed through formalised assessments as well as audits	• Quantitative measures are suggested, however, this may be difficult with factors such as measuring convenience • Audits rely on company KPIs that may not be aligned to measuring e-learning
Aguti, Walters and	• Simplified four-dimension analysis to determine effectiveness	• Based on blended learning, not simply e-learning

Wills (2013)	• Integrates readiness; ensures that a readiness assessment was done prior to implementation • Assessment of individual items can be cascaded/rolled back to establish overall effectiveness	• A large number of items (sometimes redundant) requires to be assessed in each dimension
(Vivekanant hamoorthy and Sarukesi (2012)	• The main emphasis is on self-regulation for e-learning to be effective • Student is the focal point and tasks that the student completes are mainly regulated and issued by the teacher	• May be effective in an academic setting, however, applicability in organisations is limited as it is teacher-student based

E-learning readiness framework

Alshaher (2013) adopts a multi-dimensional approach in the development of a readiness assessment framework that is built upon the seven pillars of the McKinsey model. There exist 23 different constructs or dimensions within the seven pillars that require assessment. These seven dimensions are deconstructed into hard (Strategy, Structure and System) and soft (Style, Staff, Skills and Shared values) elements. The 7S framework adapted by Alshaher (2013) served as the basis for the development of the e-learning readiness framework for this study. This framework acknowledges post implementation outcomes evaluation as a key component of e-learning readiness. The Alshaher 7S model provides insight into the readiness assessment of e-learning, due to the multidimensional framework it is built on. This model is ultimately expected to support the process to avoid failures in the e-learning implementation process, as the assessment is to be conducted prior to the commencement of the project, to identify possible pitfall and weaknesses (Alshaher, 2013, p 1948). The7S model consists of dimensions that are grouped into hard and soft elements; where hard elements are those that can be directly influenced by management, and soft elements are often not tangible and are influenced by culture.

Proposed organisational e-learning frameworks

Drawing from the basics in literature, the following organisational e-learning readiness framework indicated in figure 1, consisting of five pillars and twelve dimensions, was developed and proposed for this study.
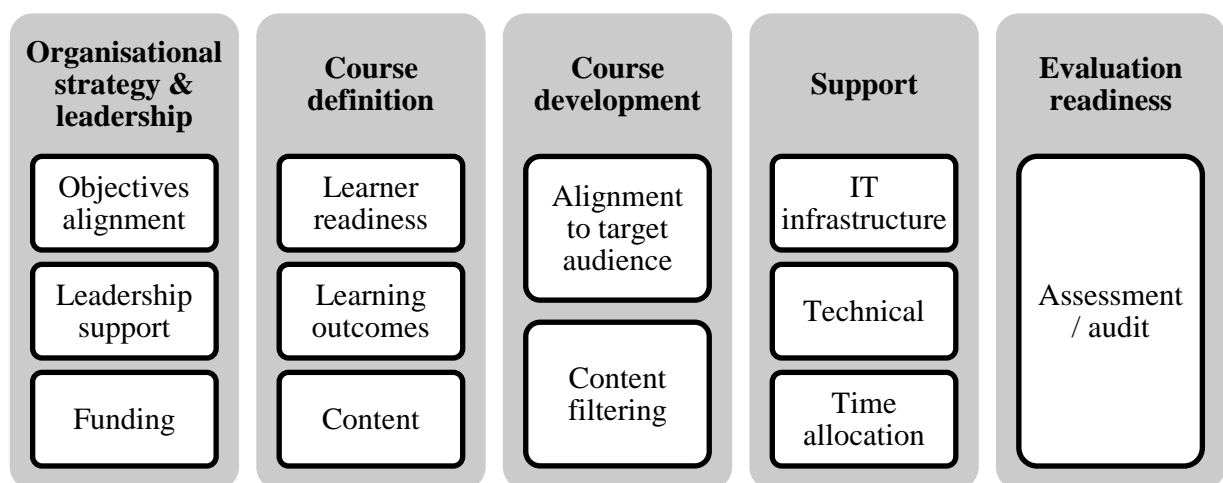
Figure 1: Proposed organisational e-learning readiness framework

E-learning effectiveness (outcomes evaluation) framework

Despite the diversity of studies and application areas of the frameworks reviewed, there was a great deal of inter-relatedness between readiness and effectiveness factors that were considered. In light of this, the outcomes evaluation framework proposed in this article also has a strong relation to the readiness framework proposed, as post implementation stage considerations heavily depend on the readiness assessment. Ruggeri et.al, (2013) proposed a model for evaluating e-learning, in the healthcare context. In the development of this model, several critical success factors for evaluating e-learning programmes are listed, by means of evaluating institutional, instructor, learner, and e-learning programme characteristics.

The framework proposed by Ruggeri et. al, (2013, p 6) assumes a number of input factors that must be established prior to implementation and during the use of the system.The outcomes evaluation framework proposed, as indicated in figure 2, has four foundational pillars consisting of nine dimensions to be assessed with a strong link between readiness and effectiveness factors, as continuous improvement indicates a reworking cycle..
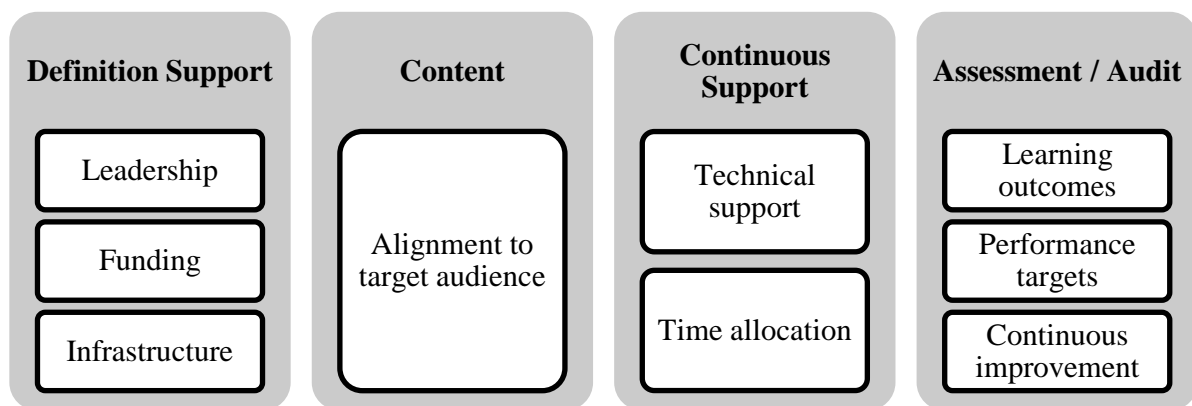
Figure 2: Proposed organisational e-learning outcomes evaluation framework

Research Methodology

The research strategy employed in this study catered for a blend of qualitative and quantitative analysis, through which triangulation was completed. Questionnaires were developed for the three main role player groups; development team, management team and system users (employees), by relating questions connected to each dimension in the conceptual frameworks. These three role player groups were focussed on to ensure that a holistic view is obtained to facilitate the testing and refinement of the generic organisational frameworks proposed.

The total population size of 180 employees in the organisational unit studies were targeted for the online survey data collection, and thus no specific sampling technique was employed. For the interview data collection, however, cluster sampling was done due to the nationwide dispersement of participants.

The online surveys comprised approximately thirty questions per role player group were used to collect data. A total of twenty-six online survey responses were obtained. Survey results were analysed by means of frequency response (mode, or percentage of responses). The aim of using frequency response was to observe where there are areas of strong and weak

correspondence amongst the results obtained. The survey acted as a diagnostic, or gap analysis tool, to establish issues and differing opinions about certain aspects of the outcomes evaluation.

From the results of the survey, detailed semi-structured face-to-face interviews were conducted to develop insight into the reasons for the responses obtained. In cases where the participant was not available for such an interaction, telephonic semi-structured interviews were conducted. A total of twelve semi-structured interviews were completed for this study, as Nastasi (n.d) suggests that data collection be stopped once no new information materialises from the respondents. Interview questions were not specifically sectioned according to the various dimensions, but rather addressed more than one dimension. The interview results were grouped into the various dimensions, based on the answers provided pertaining to the different dimensions, from which it could be established whether a specific dimension had fulfilled its outcomes or not.

Results

Table 2 indicates the consolidated results from the qualitative and quantitative analyses. The consolidated results show that only the funding and course development team dimensions, at readiness evaluation stage, had the intended outcomes being fully met. Most of the dimensions have a partial fulfilment, indicating that one or more key elements of those dimensions were not met, or that there were differences in the outcomes between the three role player groups. Results also shows that certain dimensions revealed that the outcomes were not met at all, and these were noted as major gaps in this study.

Table 2: Heat map indicating overall results of e-learning readiness and outcomes evaluation

Readiness Evaluation		Outcomes Evaluation	
Dimension	Outcome	Dimension	Outcome
Pillar 1: Organisational strategy & Leadership		Pillar 1: Definition support	
Objectives alignment	Partial	Leadership	Partial
Leadership support	Partial	Funding	Partial
Funding	Full	Infrastructure	Partial
Pillar 2: Course definition		Pillar 2: Content	
Alignment to target audience	Partial	Alignment to target audience	Partial
Content filtering	Partial		
Pillar 3: Support		Pillar 3: Continuous support	
IT Infrastructure	Partial	Technical support	None
Technical	Partial	Time allocation	None
Time allocation	None		
Pillar 4: Manpower skills		Pillar 4: Assessment/Audit	
Course development team	Full	Learning outcomes	Partial
Target audience	Partial	Performance targets	Partial
		Continuous improvement	Partial
Pillar 5: Evaluation readiness			
Assessment/Audit	Partial		

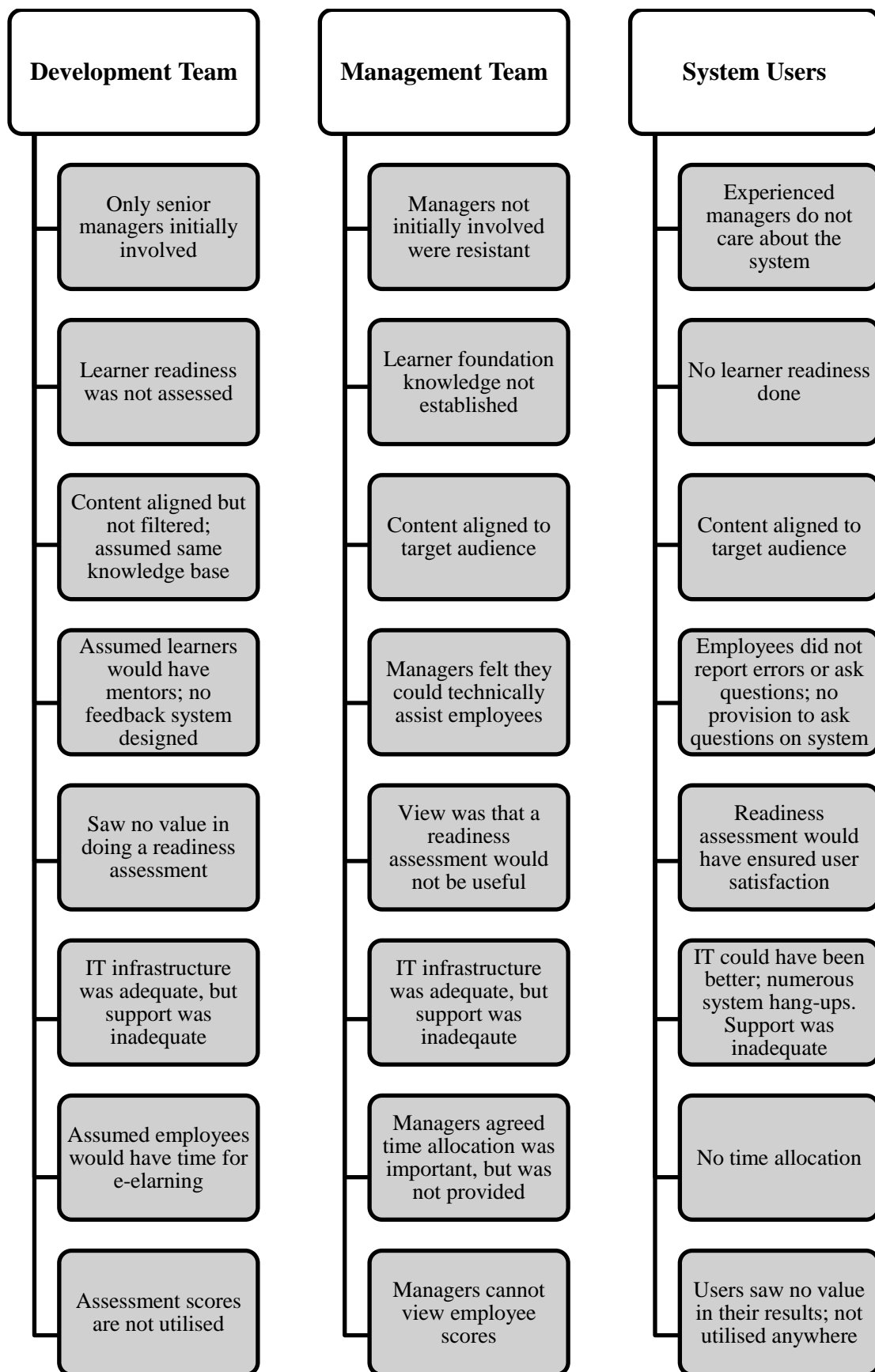| Development Team	Management Team	System Users
Only senior managers initially involved	Managers not initially involved were resistant	Experienced managers do not care about the system
Learner readiness was not assessed	Learner foundation knowledge not established	No learner readiness done
Content aligned but not filtered; assumed same knowledge base	Content aligned to target audience	Content aligned to target audience
Assumed learners would have mentors; no feedback system designed	Managers felt they could technically assist employees	Employees did not report errors or ask questions; no provision to ask questions on system
Saw no value in doing a readiness assessment	View was that a readiness assessment would not be useful	Readiness assessment would have ensured user satisfaction
IT infrastructure was adequate, but support was inadequate	IT infrastructure was adequate, but support was inadeqaute	IT could have been better; numerous system hang-ups. Support was inadequate
Assumed employees would have time for e-elarning	Managers agreed time allocation was important, but was not provided	No time allocation
Assessment scores are not utilised	Managers cannot view employee scores	Users saw no value in their results; not utilised anywhere

Figure 3: Summary of key findings of role player groups per dimension

Figure 3 indicates a consolidated view of all the key findings from the survey and interview results, where the readiness factors comprise mainly the interview findings and outcomes evaluation the survey findings. These findings are compartmentalised per role-player group, relating to the pillars of the e-learning readiness and outcomes evaluation frameworks. The key findings represent the views of the three role player groups, and it was noted that generally, the development team had a much higher positive perception that the e-learning system was meeting outcomes than the other role-player groups. This indicates that the end users' experience was greatly different to what was expected by the development and management teams. While the outcomes of the dimensions listed could possiblybe met from the perspective of the development team, the overall e-learning experience did not meet its outcomes as not all role player groups had the same experience.

Limitations of the study
The main limitation of this study is that it was conducted in a single unit/department of a large parastatal, where e-learning had already been implemented, and thus only the outcomes evaluation could be tested thoroughly with this study. The readiness aspects could thus not be evaluated prior to implementation and could only be addressed through the interview process in retrospect.

In addition, the unit sampled consisted solely of engineers, and thus the findings of this study could be influenced the engineering mindset dominance.

Conclusions
Literature suggests that effective preparation for e-learning implementation will translate into better effectiveness of the entire e-learning system (Woodhill (2004)). The organisation e-learning readiness and effectiveness frameworks proposed in this study thus cater for this interdependence between readiness and effectiveness. The development of the frameworks consisted of extraction from the literature as well as additional dimensions that the author felt was critical for a workplace, such as time allocation. These frameworks were tested by means of both survey data collection, as well as interview data collection, resulting in a mixed research method (triangulation) being followed. Both methods were considered in order to account for gaps that may arise from conducting a solely qualitative or solely quantitative study.

The results indicated that the expectations of the development team did not cascade down to the users' level, i.e. the user experience was different from the designed experience. This is indicative of one of the major gaps that will be prevalent if a readiness assessment is not performed prior to the rollout of e-learning. Due to the absence of a readiness assessment having been done, various retrospective design and process changes to the e-learning system are required in order to meet expected learning outcomes.

The e-learning readiness and effectiveness (outcomes evaluation) frameworks proposed in this study may be utilised by workplace organisations that wish to evaluate their e-learning programmes. Table 4 indicates the main activities that must be conducted pertaining to each dimension of the frameworks proposed, which can be used by organisations wishing to implement e-learning.

Table 4: Framework activities for organisations

	Pillars	Activities
Readiness factors	**Organisational strategy & Leadership**	• Ensure e-learning strategy is aligned with organisational strategy, culture and policies • Leadership buy-in should be sought at the onset • Ensure adequate funding for the roll-out is available: Quantify system requirements, resource requirements and manpower requirements to quantify required budget
	Course definition	• Inform management and system users of the planned e-learning implementation (early buy-in) • Assess employee skills, competencies and learning styles (target group) upfront • Define learning objectives per e-learning module • Establish what content can be translated into e-learning material, and the best way to represent this information
	Course development	• Ensure content is developed to align to the target audience • Ensure content is user or work-type specific • Avoid repetition of foundational knowledge; filter content for the audience • Design e-learning assessments to be engaging for the specific target audience
	Support	• Evaluate IT system capabilities. Shortcomings must be addressed through funding • Ensure technical assistance can be sought by employees; online or through mentors • Establish a time allocation strategy for employees to partake in e-learning
	Manpower	• Development team should be knowledgeable and subject matter experts should be involved in development • Literacy's of target audience should be known upfront
Outcomes evaluation factors	**Definition support**	• Evaluate whether required leadership support was provided • Evaluate whether required funding was availed • Evaluate adequacy of IT infrastructure • Create incentives to do the e-learning courses (e.g. pre-requisite for promotion)
	Content	• Evaluate through management feedback whether the courses are relevant and aligned to them/ their employees
	Continuous support	• Evaluate support offered by IT personnel and technical/subject matter experts • Determine whether mentors, managers and subject matter experts provided sufficient technical support for employees
	Assessment	• Evaluate adequacy of assessments for target audience • Ensure practical aspects of e-learning is included in employees' performance compacts • Have intervention measures in place for employees that

		consistently do not meet learning outcomes, in order to aid learning Assess whether the employee has provision to provide feedback for continuous improvement
		• Determine whether feedback from users have been acknowledged and used in order to improve the e-learning system

Recommendations

Although e-learning readiness factors were tested through the interview process, it is recommended that the readiness framework also be tested in an organisation or unit where e-learning has not been implemented, in order to determine whether a further refinement to the proposed readiness framework is required.

Further research is recommended to investigate whether the learning styles and issues noted from this study on engineers, will be present in other areas of organisations such as Finance, Human Resources etc. This will assist developers in further tailoring e-learning to discipline specific learning.

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CAN EDUCATIONAL TECHNOLOGY BE DEFINED FROM SOUTH AFRICAN UNIVERSITY FACILITATORS' UNDERSTANDING…?

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Abstract

This article presents an interpretive case study of university facilitators who reflected on their understanding of Educational Technology at a South African university. Educational Technology is about teaching/learning resources which are divided into Technology in Education (hard-ware and soft-ware) and Technology of Education (ideological-ware resources) that are used in education to organise Teaching/Learning Signals. The aim of the study was to explore the facilitators' understanding of Educational Technology and also give voice to their perceptions. The study used an email to involve all the sixty facilitators from the school of education in answering research question one. One-on-one semi-structured interviews and focus group discussion for data generation were conducted with six facilitators that were purposively selected for the in-depth data needed to answer research question two of this study. Purposive sampling together with convenience sampling was used in selecting the six facilitators from the School of Education, one facilitator from each of the school's six departments. Guided analysis was used and generated four themes for data analysis framed by Teaching/Learning Signals, Technology of Education and Technology in Education. The main findings of this study indicate that the facilitators did not understand Educational Technology. This article consequently recommends the promotion of the proposed definition of Educational Technology in order to sustain Educational Technology as the discipline that generates theories that underpin the integration of different resources in education or curriculum.

Keywords: Awareness, Teaching/Learning resource, Teaching/Learning Signal, Technology of Education, Technology in Education.

Introduction

Educational Technology (ET) was initially perceived as the use of audio-visual aids in teaching and learning. At the time Audio-Visual Education was the most suitable name for this field until the introduction of Instructional Technology (United State of America with other countries that supported this name) and Educational Technology (United Kingdom with other countries that supported this name) (Amiel & Reeves, 2008). Today with the explosion of Web 2.0 technology, a massive increase in global population and the scarcity of teaching/learning/research resources, ET appears to need a definition that suggests a framework that positions all the new technologies on contextual educational goals (Bansilal, 2015). Such framework should open/create opportunities for the members of the population who are far from educational institutions and address the scarcity of the teaching/learning resources (Khoza, 2015b). In other words, resources should be framed in such a way that they help educational institutions to spread education to people in every corner of the world.

In 2009 some South African universities unsuccessfully tried to respond to this situation by advertising Educational Technology posts. The universities that tried and failed to recruit the qualified Educational Technologists were University of Zululand, University of KwaZulu-

Natal and others. As a result, when these universities integrated any new technology in teaching/learning process they used technicians instead of Educational Technologists. Learning Management System (LMS) was one of the technologies that were being integrated by the technicians even though they had at least one Educational Technologist within the institutions who could help them to integrate education and technology into one effective unit that could promote a good teaching/learning environment (Amory, 2012; Khoza, 2015a). After the universities failed to recruit they combined Educational Technology discipline with other disciplines. The theorising process of integration was then given to the technicians. These technicians find themselves in difficult situations because they were not trained in the integration process of technology and education (Khoza, 2015e). The process tended to promote computer technology at the expense of education, as if learning was about technology (Amory, 2010).

However, the University of Cape Town, University of Witwatersrand, Cape Peninsula University of Technology, Durban University of Technology (DUT), Tswana University of Technology and others managed to keep Educational Technology as the independent disciplines/centres of excellence, where they theorise and practise the effective integration of any new required technology with education to form one unit that may help them in achieving educational goals (Czerniewicz & Brown, 2014). The centres were led by experienced Educational Technologists that helped staff members to incorporate relevant technologies in their education (Ngubane-Mokiwa, 2013).

Therefore, this suggests that the integration of technology in education should be facilitated by Educational Technologists who will be able to bring relevant theories and practices. It is for these reasons that the next section defines ET and also discusses the three important issues that unpack Educational Technology (Berkvens, van den Akker, & Brugman, 2014; Khoza, 2015c; Ngubane-Mokiwa, 2014).

Literature review
This article defines Educational Technology (ET) as a discipline/field of study that deals with the application of both Technology in Education (TIE) and Technology of Education (TOE) (Percival & Ellington, 1988) as required by curricular spider web (Berkvens et al., 2014) or Teaching/Learning Signal (T/LS) (Khoza, 2015e) with an aim of improving teaching/learning situations (Mulay & Chaudhary, 2006). TIE and TOE are the main two components of ET which frame teaching/learning resources into two main categories (Percival & Ellington, 1988) which are required by curricular spider web or teaching/learning signals. A resource in this context is "any person or thing that communicates learning" (Khoza, 2015c). TIE is any teaching/learning resource that one can see and touch (Ngubane-Mokiwa, 2013). TOE is any teaching/learning resource that one cannot see and touch (Khoza & Manik, 2015). T/LS is any of the concepts of education that constitute teaching/learning (Khoza, 2015c).

Technology in Education (TIE) is further divided into hardware and software (Percival & Ellington, 1988). Hardware is any machine or tool used in teaching and learning (e.g. overhead projectors, video cassette players, radio cassette players, desktop computers, laptops, smart-boards, mobile phones, library, classroom and others). software is any material that is produced in order for the hard-ware to display information or communicate learning (e.g. overhead Projector transparencies, computer application software, YouTube, blogs, Face

book, Learning Management System, Skype, library/online books/articles and others) (Khoza, 2015a).

Technology of Education (TOE) (Percival & Ellington, 1988) has only one component known as ideological-ware (IW) (Khoza, 2015c) or technologies of self (Foucault, 2007) (e.g. teaching/learning strategies, theories of teaching/learning, research findings, facilitators' experiences, facilitator's competencies, time, everyday/general knowledge, school/scientific knowledge and others). Educational processes appear to be demanding a third category of ET that was occupied by the systems approach (Hogan & Pressley, 1997) before it fell under the wing of TOE as one of the TOE theories. This third category needs to be redefined as the Teaching/Learning Signal (T/LS) (Khoza, 2015e) which should consist of rationale, content, context (which brings space and time), goals, teaching/learning activities, assessment (evaluation), learners and teachers (Figure 1). Figure 1 shows the three main components of ET (TIE, TOE and T/LS) (Khoza, 2015e; Percival & Ellington, 1988).
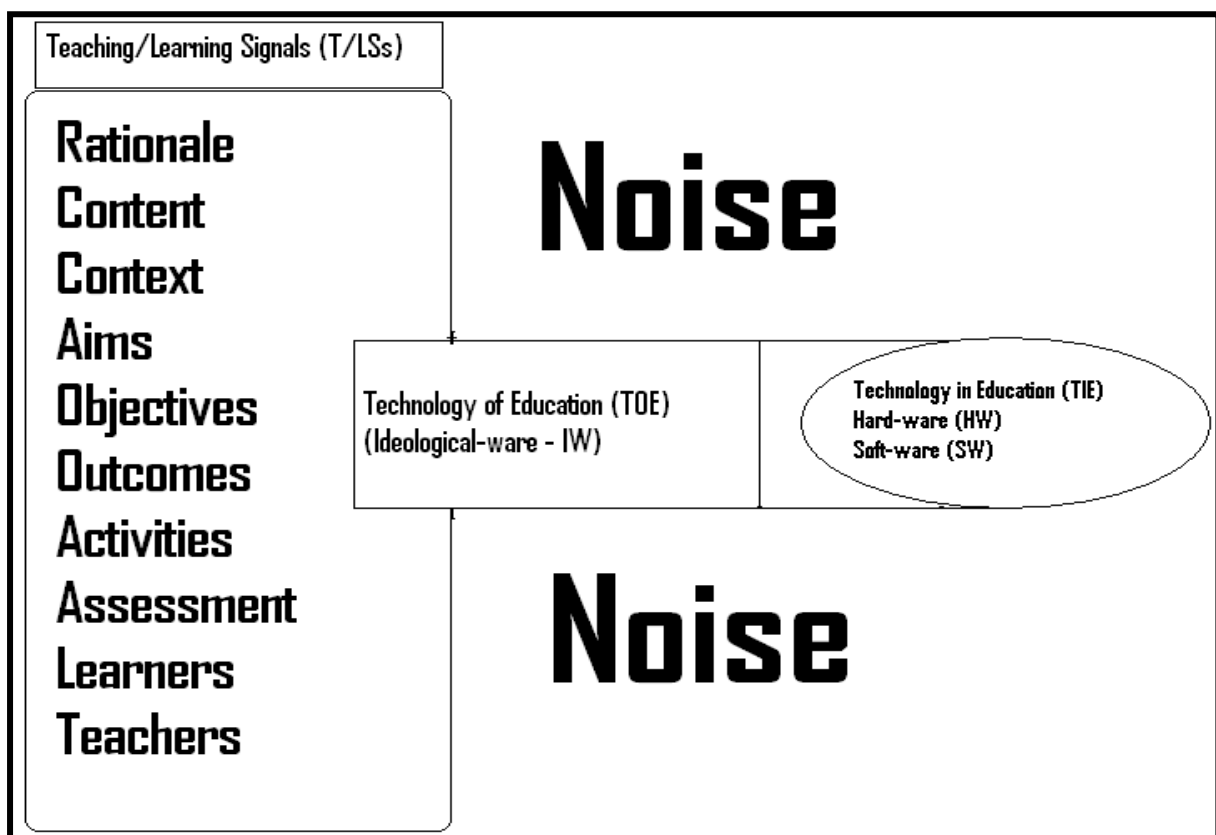
Figure 1: Educational Technology Teaching/Learning environment

Berkvens et al. (2014) and Khoza (2015e) indicated that the issues that constitute teaching/learning have to be grouped together to form a curricular spider web or T/LSs. This suggests that the teaching/learning environment has to start by defining or understanding each of the teaching/learning signals as shown in Figure 1. Once one defines or understands the teaching/learning course rationale, content, context, activities, assessment, type of learners, type of teachers for the course, teaching aims, teaching objectives and learning outcomes one stands a better chance to identify relevant TOE (IW) resources for the course (Czerniewicz & Brown, 2014). This then leads to the incorporation of relevant TIE (HW/SW). IW resources

are closer to the T/LSs because they also cannot be seen and touched in a similar way as the T/LSs and sometimes they are not separable from the T/LSs (Khoza, 2015d). In Figure 1 TOE/IW resources are inside the area of the T/LSs because they are closer to each other and it becomes impossible to teach/learn successfully without applying any IW resources because they are the ones that organise the T/LSs and identify any relevant HW/SW resource. HW/SW resources are outside the area of education because they are only included in the teaching/learning environment if they are required by the T/LSs through the IW resource. Most of these HW/SW resources were not created by education sector but they are coming from other sectors whose initial goals were to serve those sectors. For example, the internet became the most popular tool used by every organisation/sector in the world but it was intended solely for the US Department of Defence research project (Mowery & Simcoe, 2002). Education takes advantage of these innovations from other sectors which then force the education sectors to have well trained Educational Technologists to adjust HW/SW resources to suite the changing educational processes. Another example is the popular overhead projector (OHP) which also came from the same Department of Defence and was adopted by the education sector. This indicates that teaching/learning is not about HW/SW resources but is, instead, about IW resources (Khoza, 2015c) because the IW resources organise the T/LSs and identify any required HW/SW resource (Khoza, 2015e). In other words education processes start with IW resources that organise T/LSs in order to identify relevant TIE (HW/SW) resources.

The rationale for teaching a course is very important because it produces relevant teaching goals (aims/objectives and learning outcomes) of the course. Aims are general statements, which are generated according to the teachers' intentions (e.g. to introduce students to... or to make students aware of...); while objectives are specific statements (e.g. to understand or know...); that are also generated according to the teachers' intentions (Donnelly & Fitzmaurice, 2005). On the other hand, learning outcomes are also specific statements (e.g. to define, explain, criticise, draw, ask...) but they are addressed in terms of students' performance when students perform according to the relevant learning outcomes' keywords. Harden (2002, p. 153), further suggests that learning outcomes should cover a range of competences that challenge students to apply what they are learning in their professions (context based). These competences should be applicable in three categories of learning. Category one is what is expected of a student in his or her profession in terms of technical competences (HW/SW or "doing the right thing"). Category two is how their courses are being approached in their profession (IW or "doing the thing right"). Category three involves students' on-going development in their professions (Facilitator's duties or professional competences – "the right person doing it"). This means that learning outcomes should drive any course design in order to give students the right direction in learning. These issues should be explained to the students in advance so that students can work hard to achieve the outcomes, while the teachers work hard to achieve the aims and objectives.

Activities are divided into teachers' activities and learners' activities. In other words these are teachers' role and students' role that need to be carefully defined and understood before teaching/learning processes take place (Reeves, Herrington, & Oliver, 2004). These defining or understanding processes of the activities/roles should be based on the teachers' qualities and students' qualities (e.g. who is the ideal teacher to facilitate learning in this environment? Who are the ideal students to learn under this environment or context?). After understanding

all the above issues the processes lead themselves to the identification of relevant assessment processes.

Assessment in education is the process which assesses students 'for learning' (formative assessment) curriculum/content; assesses students 'of learning' (summative assessment) curriculum/content; and assesses students to become assessors themselves (assessment as learning) (Bailey & Garner, 2010). Formative assessment is the process of learning when students are assessed for their collection and processing of relevant information (Khoza, 2015c). This indicates to teachers/facilitators where their support is required without necessarily grading students (it usually takes place during the learning processes) (Harden, 2002). When students use hardware/software resources, they seem to enjoy them and they easily become a habit once they get used to them (Czerniewicz & Brown, 2014). It then becomes easy to make mistakes and the grading can lead to the failure of students (Khoza & Manik, 2015). It is then important for the facilitators to always introduce new activities that force the students to be aware of what they are doing at all times and avoid habits in learning (Khoza, 2015c). Summative assessment is a summary of formative assessment of their students' achievements of learning outcomes where facilitators are grading their students (it usually takes place at the end of learning processes) (Harden, 2002). Assessment as learning is the process where both the facilitators and students develop relevant knowledge/skills in assessment which usually come in the form of peer assessment for the students and course evaluation for the facilitators (Kennedy, Judd, Dalgarno, & Waycott, 2010). This suggests that facilitators should start their facilitation process by teaching 'awareness' so that their students would be aware of what is happening around their learning processes and be able to exploit all learning opportunities that are presented by the process and avoid habit (noise) (Khoza, 2015c).

Today, the Educational Technology environments seem to have 'noise' (attractive things that have nothing to do with teaching/learning) that mostly comes from HW/SW resources (Kennedy et al., 2010; Khoza, 2015e). When students come to universities they become exposed to different new attractive digital technology (HW/SW) such as face-book, tablets, YouTube, Skype, twitter, blogs and others, where they end up losing the Teaching/Learning Signals (T/LSs) and join the social/entertainment groups which sometimes have nothing to do with their Learning Signals for their specific university courses (Singhal & Rogers, 1999). As a result, they become addicted to these hard-ware (HW) or soft-ware (SW) resources and use general (everyday) knowledge in learning instead of school (scientific) knowledge (Bernstein, 1999; Khoza, 2015d).

Hoadley and Jansen (2014), argue general knowledge is usually unplanned and is a learned anywhere. Bernstein (1999), argues that everyday knowledge usually comes either from overheard social conversations or different hard-ware/soft-ware resources. It is usually based on people's opinions within a particular local context, which makes it impossible to be repeated because it usually comes in the form of oral information (Freire, 1993). On the other hand, school knowledge is specific to each field of study (Tyler, 2013). This suggests that it is formally learnt according to different fields of study.

Research Objective and Research Questions
Therefore, this article intended to explore facilitators' understanding of Educational Technology in order to understand and define educational technology. This article may help

higher education institutions to answer the question of 'why do facilitators understand Educational Technology in a particular way?' The data production was organised to respond to the following research questions:

- What is the facilitators' understanding of Educational Technology at a South African university?
- What are the facilitators' explanations of understanding Educational Technology in particular ways?

Research Design and Methodology
This study followed the interpretive qualitative case study of six South African university facilitators from one university with many departments/schools. However, the study started with sixty facilitators from the School of Education which is divided into six departments. Qualitative case study is important for this study because it is more descriptive, holistic, explorative and contextual in its design and aims to produce rich description of explored phenomena (Creswell, 2014). For this study, qualitative case study has helped to understand the deeper meaning of the facilitators' understanding of Educational Technology because it is important at higher education level (Clare & Sivil, 2014).

Sampling
Purposive sampling was used in selecting all the sixty facilitators from the university's School of Education to answer the first research question through an email which was sent to all of them with only one question (what is your understanding of Educational Technology or what is Educational Technology?). The second research question, which looked for the in-depth description of the facilitators' explanations of understanding Educational Technology in particular ways, was answered by only the six most accessible facilitators, one from each of the six School of Education's departments through semi-structured interviews and focus group semi-structured discussion. The six facilitators all represented their departments in the university Technology Integration Committee (Convenience sampling). The six facilitator's names were not revealed because of ethical considerations as suggested by Creswell (2014). Informed consent and ethical considerations were acquired in terms of confidentiality, voluntary participation, benefit and anonymity. In this study they will be referred to as Participant 1, 2, 3, 4, 5 and 6.

Data generation/production and analysis
Methods used in this study for data generation/production were: email for the sixty facilitators to answer the first research question; semi-structured interview and semi-structured focus group discussion for the six facilitators to answer the second research question. The email was administered once and both the interviews and discussions were each administered twice and were about thirty minutes long. The three sources of data were used for the purpose of enhancing trustworthiness validity of data (Clark, 2000) and achieving measures of trustworthiness (Krefting, 1991). Audio-tape was used to record the interviews for ease transcription. This was done to verify that the data gathered was consistent across the three sources of data, that triangulation, transferability, dependability, confirmability and credibility were supported and to ensure trustworthiness of the findings.

In terms of data analysis this study used guided analysis where researchers have categories that can be modified through interaction with data (Samuel, 2009). The findings are

exploratory in nature; four themes with categories were generated from the data and ET components.

Findings
Table 1 of findings is presented to answer the first research question and narrative stories (mostly by means of direct quotations to answer the research questions to enhance trustworthiness) for each of the six participants followed by discussion of findings under the four themes and substantiated with discussions to re-contextualise them with relevant literature.

Table 1: Findings generated from the email

Definitions from the facilitators	Number of Responses (N=60)
Audio-visual aids	07
Technology Education	19
Computer technology	18
Internet	03
Internet in teaching/learning	02
Teaching/learning from technology	02
Technical resources for teaching/learning	01
Teaching aids or equipment/materials	03
ICT	05

Findings generated by the semi-structured interview and focus group discussion
Participant 1: '*I responded to the email question by defining Educational Technology as Technology Education because it is only about applying technology in education... In my modules I sometimes use MOODLE... I attended three workshops on MOODLE and they were all conducted by our university administrators. I do not think that Educational Technology is a field of study because anyone can use technology in teaching without any formal training... People should use and enjoy technology freely to communicate with friends whenever they feel the need in their activities... The moment you talk about theories you start to push people away... To access technology I use my university computer and my phone (BlackBerry) and I do not think I need more than this because I even access online library books using these two machines...*'

Participant 2: '*I define it as audio-visual aids used in teaching because it is about what we use in teaching to help our students to understand the module content... it cannot be a field of study but it can only be a short course where people learn new technology for teaching... I do not use online teaching but to access my email, what's up and Face-book I use my university office computer and my Tablet phone... but I do not use the online in my teaching because I enjoy the use of basic teaching aids of which others are easily accessible from the library for both facilitators and students... I did ET in my B.Ed honours where I could remember these concepts of Technology in Education, Technology of Education and systemic approach but I did not understand them because it was a short course in AV [audio-visual]... I think education deal with fundamental issues of life that include curriculum delivery, achievement of objectives or outcomes, asking students some questions, answering to students' questions and assessment of students...*'

Participant 3: '*Educational Technology is the use of internet and other computer applications in teaching or learning to interact with content and assessment strategies and other activities... I use my Tablet phone together with my office computer to access my email, Face book and online discussion forum with limited use of the library resources because I do not have much time for the library because my Tablet phone has enough space to download information from many sources. The only online tool I use in teaching is Discussion forum... I enjoy these online system without any formal training although I attended three presentations on MOODLE which I found them not useful for me because they were more on designing websites and not much on designing an effective teaching or learning platform...*'

Participant 4: '*It is the use of computer technology or ICT in teaching and learning... I do not think it is different from computer studies... It should be using computer science theories to underpin technologies in teaching... Theories like connectivism, activity theory, constructivism, actor network theory... are useful in teaching using technology... but I use systems approach in teaching information system... I use Face book, twitter, YouTube, blogs, Skype and Whatsapp for entertainment or social... I only use online sources which I access them using my office computer, personal laptop, iPad...*'

Participant 5: '*It is defined as the teaching aids for presenting the content to students... it is not a field of study on its own because all teachers learn about teaching aids in their degrees... New technology in teaching does not need training because it is interesting everyone enjoys it... I have just change my iPad to Tablet because I want to continue to enjoy the latest technologies but I do not use these technologies for teaching because students do not afford...*'

Participant 6: '*...for me it is about technology of technical education or equipment and materials which can include the latest technology used in teaching... It should not be separated from technical or technology education or even computer studies...*'

Discussion of findings
Theme one: Email responses in Table 1
The results in Table 1 indicate that the participants only understood Educational Technology under one category (TIE or HW/SW) of the three categories that are presented in Figure 1. Nineteen of the sixty participants which is the majority define Educational Technology (ET) as Technology Education. Technology Education (TE) is learning about technology (HW/SW) but not learning how to apply the technology in education with an aim of improving teaching/learning environment like ET. TE involves learning about technology in a general sense not specifically for education.

Eighteen of the sixty facilitators defined ET as Computer Technology (CT). CT is about learning how to build computers and use programming languages unlike ET which moves beyond computers. Seven of the sixty define ET as audio-visual aids which suggests that they define it as TIE (HW/SW) which considers only one component of ET.

Five of the sixty defined it as Information and Communication Technology (ICT) which is also a TIE (HW/SW) resource. Other definitions defined ET as Internet, Internet in teaching/learning, teaching/learning from technology, technical resources for

teaching/learning and teaching aids or equipment/materials which suggest that they are all pointing at the TIE division of ET.

Theme two: Technology in Education (TIE)
The findings suggest that the participants define Educational Technology as Technology in Education in terms of the following hard-ware (HW) and soft-ware (SW):
HW – Audio-visual/ICT tools/machines, computer, laptop, iPad, Tablets, desktop, mobile (blackberry) and library.

SW – Face-book, discussion forum, Tablet software/application, iPad software/application, blogs, YouTube, twitter, Whatsapp, MOODLE and Skype.

Although these facilitators did not understand the main concepts of Educational Technology (ET) as a field of study, their definitions appear to describe only one concept of ET which is Technology in Education (TIE). TIE resources appear to be outside the compulsory issues of education (T/LSs) as shown in Figure 1 because they are not always compulsory in the teaching/learning environment. For example, if facilitators want to tell their students a story in their classrooms they may not need any TIE resource because their proximity allows them just to verbally convey the story by talking to students, but if they are at a distance it may be compulsory for them to use TIE resources like email, mobile phones or other relevant resources. It may be compulsory for Participant 4 to apply TIE resources because she had more than 200 students. According to Amory (2010, 2012), if education is determined or driven by technology it means that students learn from technology instead of learning with technology. This should be avoided because it indicates that learning is about technology and no longer about ideology. Ideology is what constitutes the Technology of Education resources that organise the Teaching/Learning Signals (T/LSs).

Theme three: Technology of Education
The findings suggest that the participants involve the following ideological-ware (IW) in their practical definition of Educational Technology:
IW – Constructivism, system/systemic approach, connectivism, Activity Theory, question-answer method, technology language and Actor Network Theory.

Even though the facilitators were not aware of Technology of Education in their definitions, they used it because of the above Technology of Education (TOE) (IW) resources. As a result, they defined ET as the HW/SW resources because they were not aware of IW resources. Teaching/learning is about applying IW resources by organising both relevant T/LSs and TIE (HW/SW) resources to produce effective teaching/learning environments. This suggests that teaching/learning may not take place in the absence of IW resources. For example, it facilitators have to teach their courses they apply certain theories from their experiences which may be teacher-centred or learner-centred or a combination of the two or any other approach. According to Hoadley and Jansen (2014), there are three approaches in which facilitators choose from in order to ground their teaching. The three approaches are Ralph Tyler's objectives approach (Tyler, 2013), Lawrence Stenhouse's process approach (Stenhouse, 1975) and Paulo Freire's critical approach (Freire, 1993).

Tyler's objectives approach is driven by objectives that need to be defined or identified before any teaching takes place (Tyler, 2013). The defined/identified objectives should be followed by content, teaching activities and then assessment strategies. This approach favours the teacher-centred approach and tends to promote passive students who do not question their teachers in most cases (Khoza, 2015d).

Stenhouse's process approach favours the learner-centred approach as it starts the teaching process by identifying students' learning activities in order to drive a lesson (Stenhouse, 1979). In this approach students learn through their activities that are facilitated by their facilitators.

Freire's critical approach is guided by values and question of power content based on key themes from students' lives (Freire, 1993). It aims at promoting active and critical students who are exposed in a political empowerment curriculum.

Theme four: Teaching/Learning Signals (T/LSs)
The findings suggest that other facilitators were aware of some of the T/LSs such as the content, objectives, outcomes and assessment. Although they were not aware of the difference between the teaching objectives and learning outcomes but in practice they seem to involve the identification of certain T/LSs. The choice to choose the Teaching/Learning Signals (T/LSs) depends on the facilitators' experiences and competences (Khoza, 2015e). For example, if teachers expect passive students they may use Tyler's approach where they may start their lesson planning with aims together with objectives, course content, teaching activities and assessment together with evaluation. If facilitators like active students they may use Stenhouse's process approach by starting the planning with learning activities together with definition of learners' qualities before any other signal. For questioning students, facilitators may choose Freire's approach which deals with teaching for political empowerment and power.

Conclusion
In conclusion this article is starting a debate/discourse by challenging all Educational Technology definitions that exclude any of the three ET components/concepts (as shown in Figure 1). It may be observed from this study that the teaching/learning process should always start with TOE/IW followed by T/LSs (to be organised by TOE/IW) and then TIE (HW & SW). This definition may help by bringing back all the parts of Educational Technology that seem to be missing because of the new attractive technology (TIE resources). The definition emphasizes the important of TOE (IW) resources and T/LSs more than TIE (HW/SW) resources in any teaching/learning environment. Therefore, defining Educational Technology from the participants' understanding may not help education because it is dominated by Technology in Education (TIE) also known hard-ware (HW)/soft-ware (SW) resources and exclude Technology of Education (TOE)/ideological-ware (IW) resources.

Recommendations
Therefore, this article recommends that Educational Technology (ET) should be defined as a field of study that uses Technology of Education (TOE) (Ideological-ware – IW) resources to organise Teaching/Learning Signals (T/LSs) and identify relevant Technology in Education (TIE) (hard-ware – HW & soft-ware – SW) resources for teaching/learning environments in

order to improve teaching/learning processes. This definition may help in producing a new understanding for the digital age that frames education together with technology to form one teaching/learning process.

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UNDERSTANDING THE RIEMANN PROCESSES: THE MERIT OF TECHNOLOGICAL INTEGRATION INTO THE USUAL PRACTICES

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Abstract

In this paper we highlight the merit of technological integration into the usual practices in teaching and learning the concept of Riemann integral, especially on stressing the aspects of meaning in those two educational processes on dealing with that mathematical demanding idea. The study was carried out in June 2013, with 8 first year undergraduate students in Mathematics Teaching Course, at Beira Campus. The course is aimed to train teachers of Mathematics for secondary schools. The study was to answer the question on how could the integration of Geogebra Software into traditional approaches be worthwhile strategy to teach and learn effectively the concept of definite integral at schools institutions. The research was grounded on Anthropological Theory of Didactic, Theory of Instrumentation and the notions of students' expected knowledge. It was qualitative research in form of case study, and we used some ideas of didactical engineering comprising the design, implementation, observation, *a priori* and *a posteriori* analysis and internal validation of teaching sequences. The experiment showed that the integration of technological settings into canonical practices promotes sound understanding on Riemann integral since it unmasks what this concept is all about and motivate students' interventions and questionings.

Keywords: Riemann integral, anthropological theory of the didactic, theory of instrumentation/instrumentalization, computer environment and retrospective knowledge.

Introduction

Riemann integral is one of the fundamental concepts in mathematical analysis whose central notion is the notion of accumulation of quantities in an infinity process which becomes completed totality through the limit process. Problems of area, distances, arc lengths, volumes, work, pressure and hydrostatic force, moments and centers of masses in Physics; consume surplus in Economy; blood flow and heart capacity in Biology; Probability in Statistics, all these are, among many areas, the applications of unique mathematical concept, the definite integral. The versatility of this concept motivate, by one hand, its incorporation in mathematics curricula at some secondary level courses and, almost indispensable in many university courses. And, in other hand, the subject causes teaching and learning difficulties at schools institutions, leading to several studies on the matter aiming to document and clarify the nature and causes of those difficulties, and at the same time, to lay down some didactical alternatives to deal with the topic.

In fact, according to Skemp (1991, cited by Corrêa, 2008, p. 82), the problem facing the teaching of mathematics is not about the rigor, but the development of meaning, the existence of mathematics objects. The meaning is lost if teaching consists only in conveying the information.

To Valente (2005), Villarreal (1999), Artigue *et al.* (2003), Borba (1993), among others, the difficulties are, in nature, procedural and conceptual and they raise from teaching process itself. From this point of view, we think that computer may help to explore and analyze in what truly interests to discuss in classroom, as the students may explore quickly

and meaningfully several examples with different representations and, then, try to draw apprehension of the underlying content from worked examples.

The content of this article is a part from large study on "*Derivatives of real functions of a real variable and Riemann integral*: *construction and learning of concepts mediated by media and usual practices*". In these researches we try to understand in what way the computer maybe helpful instrument (artefact in use) to teach and learn Calculus.

The motivation to systematically relate the computer and usual practices rise from our feeling that to learn through meaning is the way to understand what you are learning and if you do not understand you are not learning. And so, we think, computer used appropriately conveys aspects of meaning of some content, and, consequently, promotes understanding, the condition of learning. This claim is shared by many researchers in Mathematics Education, like those already cited above: Villarreal (1999), Artigue *et al.*, Borba (1993), Vianna (1998). Borba, for example, highlights the computer setting in the following way:

> […] regarding changes in mathematics, mathematics learning, models for understanding in computer contexts, the inter-shaping relationship between computers and mathematical ideas, the models for transformations of functions based on visualization, etc. is pertinent for teachers and students who are in a classroom where computer technology is available. […] They taught me how one can think mathematically using a computer software not only as something that makes things faster, but as a "real" part of one's thinking. (Borba, 1993, pp 347-35).

Therefore, learning might imply thinking, identifying the nature of object in play. Understanding the transformations of functions through representation in different ways, shaping relationships of happenings, understanding bonds among objects and how it goes to generalizations. We think the computer is particularly good to make transformations and refinement of them leading to sound actions and generalizations.

Next we present the theoretical framework.

Anthropological theory of the didactic

The Anthropological Theory of the Didactic - TAD – considers mathematical activities in the broader range of human activities regularly developed, describing the mathematical knowledge in terms of praxeological organizations or praxeologies $\wp$ whose basic notions are the notions of types of tasks T, techniques τ (ways of solving the tasks), technology θ (a rational discourse aimed to *justify*, *explain* and to *produce* techniques) and theories Θ (aimed to *justify*, *explain* and to *produce* technologies) that allow to model the social practices in general and the mathematics activity, in particular (Chevallard, 1999, 2014). From this point of view, according to the author, the praxeology $\wp$ consists of a practical-technical block $\prod$ (praxis) [type of task/technique], which corresponds to a know-how, and a technological-theoretical block (*logos*) [technology/theory] which corresponds to a knowing. The notion of task presupposes a relatively precise object, for which there is some available technique with a technological-theoretical surrounding, more or less explicit. In most cases, a task (and the type of associated tasks) is expressed by a verb evoking an action, what exists to be done, for example, integrating the function $f(x) = lnx$ between x = 1 and x = 2 is a task that can be justified with technology of integration by parts and as theory, the Fundamental Theorem of Calculus.

The following definition, taken from Labarre (2008) is the one of the most important results on Riemann integral:

Let f be a real function of a real variable in interval I = [a, b]. We say f is *integrable in I* (in Riemann sense) if and only if there is a number, denoted by $\int_a^b f(x)dx$ and called *integral* of f over *I*, such that, for any $\varepsilon > 0$, there is a partition P_ε (P_ε generally depends on ε) so that, $P \supset P_\varepsilon \Rightarrow \left| \sum(P, f) - \int_a^b f(x)dx \right| \square < \square \varepsilon \square \square$ understood that the inequality holds always an arbitrary number from the set of numbers $\{\sum(P, f)\}$ is replaced by number $\sum(P, f)$. (Labarre, 2008, p. 147).

We recall that the partition P of real interval I = [a, b], with more than one point, is a finite subset of points $P = \{t_0, t_1, t_2, \ldots, t_n\}$, such that $a \in P$ e $b \in P$, and $a = t_0 < t_1 < t_2 < t_3 < \ldots < t_{n-1} < t_n = b$. The relation $P \supset P_\varepsilon$ implies that the partition P refine the partition P_ε. In Labarre's (2008) view, the refinement process of I is the key idea on Riemann integral. We completely subscribe with this view and we believe that the geogebra software is very good to perform a such process of refinement. We also recall that the definition above does not distinguishes the type of partition P, whether regular or irregular. And, because of our limited capacity on computer programming, we used regular partition, and we think there was no loss of generality in terms of implied result.

According to Chevallard (2002), the set of conditions and restrictions that allow the mathematical development (ecology of a mathematical praxeology), ie, conditions and restrictions that allow the production and use of tasks in institutions, depends on the ostensive objects (perceptible to the human senses and capable to be handled, such as sounds, graphics and gestures) and non-ostensive objects. We assume the geogebra software as an ostensive object that allows to materialize and handle a mathematical knowledge.

The non ostensive objects, according to the author, are those, such as ideas, intuitions or concepts institutionally existing, but can not be seen, perceived or shown by themselves. The non ostensive objects can only be evoked by an appropriate manipulation of certain associated ostensive objects. For example, to find the integral $\int_0^1 x^2 dx$, we have to evoke some ideas, principles and laws of integration that can't be seen, but they materialize the object in question and drive the solver's actions to get the needed result. In the next section we present important ideas on theory of instrumentation.

Theory of instrumentation

We chose to study some aspects of Instrumentation/Instrumentation theory from the perspective of Rabardel (1995), considering it important to the analysis of the relationship between researcher and students in their effort to interact with the tasks and with computer during the discussions in experimental work sessions.

Rabardel (1995) states that instrument replaces some functions from others, rebuilds and reconstructs the whole structure of behavior. We feel that using geogebra software, changes the practices of teaching and learning Riemann integral, and the possibilities of abstraction and generalization of this concept. According to Vygotsky, cited by Rabardel (1995), the activities with instruments are at the heart of the constitution and working of the superior psychic functions for the human being. In our view, those processes, of the constitution and working of the superior psychic functions correspond to the knowledge building by involved actor, the student.

The intermediary position of the instrument makes it as a mediator of the relationship between the subject and the object. It is an intermediary world, whose main characteristic is to be adapted both to the subject, as to the object. This adaptation occurs in material terms and in terms of cognitive and semiotic properties according to the type of activity in which

the instrument is inserted or is intended to be inserted. Thus, two types of mediation are identified:

- a mediation from object to the subject, described as an epistemic mediation, in which the instrument is a means enabling the user to know the intended object;

- a pragmatic mediation, from subject to the object, in which the instrument is a means for transforming action (in a broader sense, including control and regulation) directed to the object.

We recognize here two purposes of mediation: to bring the intended mathematical object to be known by knower through its characterization and description. The use of instrument is part of knowing. In other hand, we have actions on object to find the intended solution. In this last case, the actor knows that there will be a solution and the nature of solution. He uses the instrument to access the solution.

It is worthwhile to mention that the instrumental elaboration by the user is thus, addressed, both for himself (this is the dimension of instrumental genesis called instrumentation), and for the artifact (the instrumentalization dimension).

Instrumentation processes are related to the emergence and evolution of the use of schemes and action mediated by the instrument: its constitution, its functioning, its evolution by accommodation, combination, coordination, inclusion and mutual assimilation, the assimilation of new artifacts to the set of the schemes already existing.

The *instrumentalization processes* are related to the emergence and evolution of artefactual components of the instrument: selection, consolidation, production and institution of functions, deviations and catachresis, assignment of property, artefactual transformation (structure, function, etc.) that prolong the creations and achievements of the artefacts whose limits are difficult to determine. In these circumstances we assume Geogebra as an instrument, mediator of learner's actions to construct knowledge or to find solutions of problems.

In the sequence, we highlight the research method.

Method

According to Marconi and Lakatos (2005, p. 83),

> […] the method is the set of rational and systematic activities which, with more certainty and economy, allows to achieve the objectives – to build valid and true knowledge – tracing the path to be followed, detecting errors, and assisting researcher in decision taking (Marconi and Lakatos, 2005, p. 83).

According to this perspective, we consider the method as an operational procedure (conceptual or instrumental) used in producing and treating data to obtain the results. Robert (1992) corroborates with this view on method, stressing that it corresponds to the ways of conducting the researches, especially at its experimental part, characterizing the unity between the problem put forward and available means to get the results.

We implemented experimental study in two sessions, of an hour and half for each session. The discussions took place at computer room with approximately 40 machines operating appropriately. Eight voluntary students attended the experiment and they sat in pairs to favor interactions and exchanges of ideas. As already said, the computer was integrated into usual practices in which the teacher presents the tasks to the students and they try to integrate it to their mental structure. Our goal, as we highlighted at the beginning, was to experiment a modality of teaching and learning the concept of Riemann integral articulating in these processes the Geogebra software and with current practices. And we

intended to answer the question: how could the integration of *Geogebra* software into traditional approaches be worthwhile strategy to teach and learn effectively the concept of definite integral at schools institutions? It was qualitative research in form of case study and the data came from discussions in a dialogical way: the teacher put forward questions, suggested ways of interpretation and the students studied the tasks, the questions and suggestions, questioned on the meanings and tackled the tasks. The data analysis was based on theoretical framework, checking the meanings of the content produced by students in there interaction with the tasks.

In the following pages we highlight some developments and results.

Developments and results

Because of space, we present in this article the discussions on task 2 carried out in session two. In task one, carried out in session one, were discussed the notions of partition of an interval *I*, supremum, infimum and oscillation of *f* in *I*, the *lower sum* of function *f* relatively to partition *P*, designated by $s(f, P) = \sum_{i=1}^{n} m_i(t_i - t_{i-1})$, the *upper sum* of function *f* relatively to partition *P*, indicated by $S(f, P) = \sum_{i=1}^{n} M_i(t_i - t_{i-1})$ and the corresponding oscillation of sums of function *f* relatively to partition *P*, notated by $\sum_{i=1}^{n} \omega_i (t_i - t_{i-1})$.

The task two:
Form of tasks given to the students

Name _____, Beira ___/___/2013

Consider the function *f*: [0, 1] → IR, defined by $f(x) = x^2$
Consider the partitions P_i of [0, 1].

$P_1 = \left\{ 0, \frac{1}{2}, 1 \right\}$, $P_2 = \left\{ 0, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, 1 \right\}$,

$P_3 = \left\{ 0, \frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}, 1 \right\}$

We see that P1 ⊂ P2 ⊂ P3. And so, the process may continue.

When that happens we say the partition P_i refines the partition P_{i-1}. In our example, P_2 refines P_1, and P_3 refines P_1 and P_2.

As in previous example, find the numbers s(*f*, Pi), S(*f*, Pi) and ω, and show your calculations, making a corresponding drawing, preferably using different colours for each number.

Figure 1

The following are some results obtained by students and some specific comments.
Example of a response by group 2 to the task 2
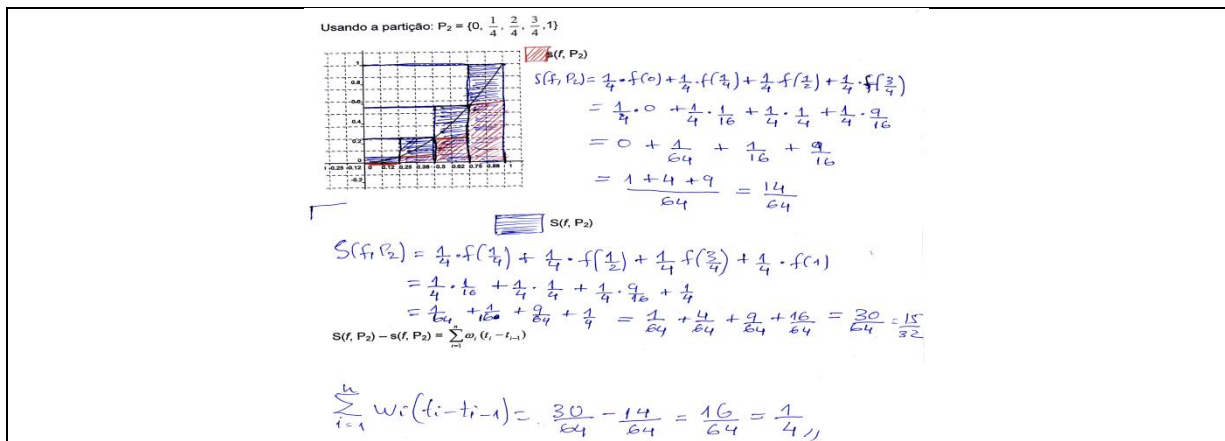
Figure 2

In the response above, the students understood the strategy used, but make some errors in adding fractions.

Example of a response by group 4 to the task 2
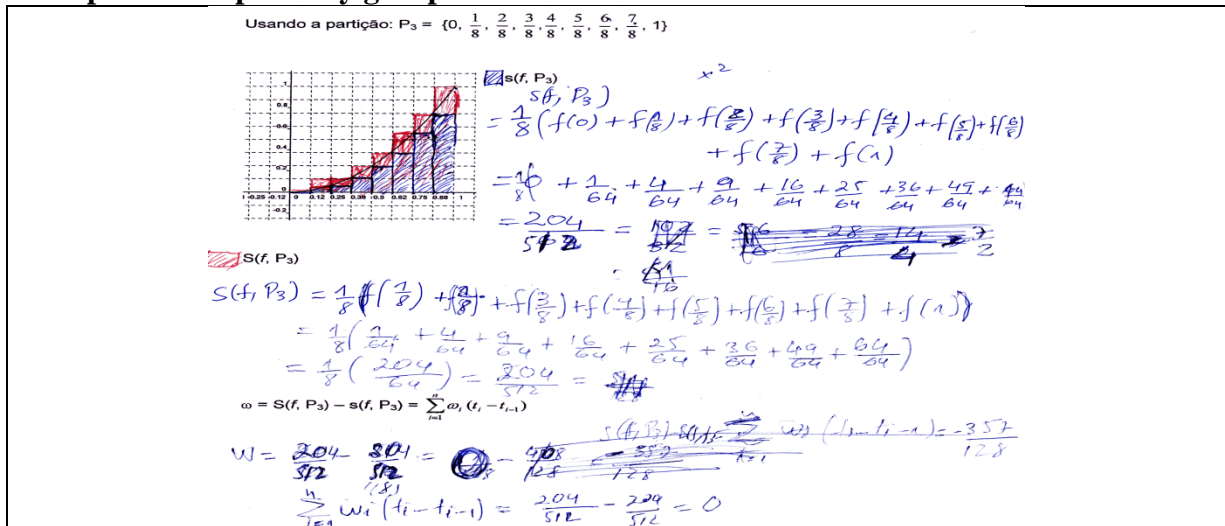
Figure 3

The students of this response understand the need to put the common factor in evidence, very important strategy which leads to the general way to calculate sums of this nature.

We consider that the students' response gives an indication of understanding the basic procedures which leads to definition of the Riemann sums, and consequently, definite integral. The refinement process of partitions of interval *I*, enabled by materials specially prepared for that purpose, corresponds to the key ideas to the Riemann integral, as also stressed by Labarre (2008).

Using computer the students improved significantly their understanding on convergence aspects of uppers sums and lower sums and subsequent formalization, as we see at the extracts:

Group 2:   Delta becomes constant. ... Only n changes. At this stage the students have the numerical results and corresponding graph, as shown at the Figure 2.

   Tutor: […] The size of rectangles, what happens? And, as consequence, how is it

Upper and lower approximating areas under graph of function f: [0, 1] $\rightarrow$ IR, $f(x) = x^2$ produced by students in pairs.

S$_i$ and S$_s$? How is it about lower sum? Upper sum, in those conditions? There are consequences. There are some consequences. Then which are the consequences? You have to talk about n, about delta, talk about lower sum, about upper sum […].

f(x) = x² (0 ≤ x ≤ 1)
n = 65536
Δx = 0
Si = 0.3333
Ss = 0.3334
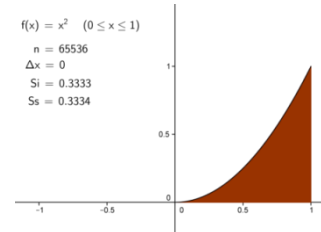
Figure 4:

Tutor: What will be the area of this part here, under the graph (of $f(x) = x^2$), on interval I = [0, 1]? You are already seeing, is not it? Each one must try to show what must be the exact area.

Up to this moment the students have the tables filled, as it is shown at a small part at Figure 5, accompanied with the corresponding graphic image, at each iteration, as in Figure 4.

Table filled by students during analyze and performing the approximation processes.

n	4096	8192	16384	32768 (26244)	65536	131072
$\Delta x = \frac{1}{n}$	.01 0002	0,0001	0,0001	.0	0	0
$S_i = \sum_{i=1}^{n} \Delta x f(x_{i-1})$	0,13332	0,13333	0,13333	0,13533	0,13333	0,13333
$S_s = \sum_{i=1}^{n} \Delta x f(x_i)$	0,3335	0,13334	0,3334	0,13334	0,13334	0,13334
$W_i = S_s - S_i$	0,0002	0,0001	0,0001	0,0001	0,0001	0,0001

Figure 5:

Tutor: Yes. What is the exact area, it is what I'm asking for, what you are seeing from there (in Figure 5). [...] How is it Si, and Ss in this case? Don't you have any idea what should be the exact area … or is there a group that has an idea about what should be the exact area?

Student (Micas): Yes. I have some ideas: (the students responds to the questions a), b) and c) on reflections section of the form):

a) What happens to the monotony for each of the following elements: n, Δx, S$_i$, S$_s$?

Student: The values of n are growing up, increasing; the values of Δx are diminishing, decreasing; the values of Si are growing up, increasing; the values of S$_s$ are diminishing, decreasing

b) The answers to the question a) are related. Try to find the meaning of these responses when compared to the number and sizes of rectangles involved in different interactions.

Student: The size of rectangles involved in different iterations, in case of number 1 we have big rectangle, when value of n increases, the rectangles diminish their size, and the values of upper sum diminish as well, while the values of lower sum increase.

c) What must be the exact area of region under analysis? Why?

Student: With the increase of n, the exact area of the region in analysis will be the lower sum (0,3333). Because each time we increase the value of n, the part of upper sum tends to vanish.

Tutor: Well, this is the Mica's response, I don't know what others groups say?

This short dialogue shows at what extent the "computer integrated environment" was a "real" part of students' thinking if we judge the situation in Borba's (1992) ways.

After those interventions we present another sequence of dialogues driving to formalization:

[...]

Students: The lower sum is bound.

Tutor: Really the lower sum is bound. Let us write that (on white board. The tutor writes: "The sequence of lower sums is bound"). It is upper bound and lower bound.

Student: And it is monotonous. It is increasing and monotonous.

Tutor: According to Nicolau (last student) the sequence of lower sums is increasing and monotonous. Then, there is a theorem which states that: "A sequence that is monotonous and bounded is convergent". I don't know whether know that theorem. Do you know it or not?

Student: We know a theorem that states: "A convergent sequence is bounded".

Tutor: Yes. That theorem exists as well. A convergent sequence is bounded. Yes. It is another theorem. It is a theorem about convergent sequences. But also, a sequence that is monotonous and bounded is convergent. To say that it has a certain limit. Well, we are analyzing sequences of sums of areas. Then what will that limit mean for you?

Students: The exact area. Exact area. …

Tutor: The exact area. That limit will mean exact area under the graph of f in interval I. Then exact area must be the limit to what tend the sequence of lower sums when n grows indefinitely. We can write as follow: "The exact area must be the limit of the sequence of lower sums when n grows indefinitely: $\lim_{n \to \infty} s_i$. How do I obtain a lower sum?

Students: ...

Tutor: Observe that for s_2, for example, we have the sum, i equals to 1 up to 2. Yes?

Students: Right.

Tutor: Let us consider n equals to four. (Pointing successively the points of partition): Here we have zero (starting point). Here one fourth, two fourths, three fourths and four fourths (last point). Here, for example (3/4) means i equals to three. At the left extreme of i we have three minus one, at next interval we have four mines one. To calculate, for example the area o rectangle 4, I have to multiply f of three fourths by delta x. That's why we say this x_{i-1}, that is over there, is of the form, i minus one times delta x. (writes: $x_{i-1} = ((i − 1) \cdot \Delta x)$). Then I replace:

Example on how to interpret the extremes in order to insert its value in a formula.

Figure 6

Exact area $= \lim_{n \to \infty} \sum_{i=1}^{n} \Delta x f\left((i-1) \cdot \Delta x\right)$. The next developments result:

$$\text{Exact area} = \lim_{n \to \infty} \sum_{i=1}^{n} \Delta x f\left((i-1) \cdot \Delta x\right) = \lim_{n \to \infty} \sum_{i=1}^{n} \frac{1}{n} \cdot f\left((i-1) \cdot \frac{1}{n}\right) = \lim_{n \to \infty} \sum_{i=1}^{n} \frac{1}{n} \cdot \left((i-1) \cdot \frac{1}{n}\right)^2 =$$

$$= \lim_{n \to \infty} \sum_{i=1}^{n} \frac{1}{n} \cdot (i-1)^2 \cdot \left(\frac{1}{n}\right)^2 = \lim_{n \to \infty} \left(\frac{1}{n}\right)^3 \sum_{i=1}^{n} (i^2 - 2i + 1) =$$

$$= \lim_{n \to \infty} \left(\frac{1}{n}\right)^3 \left(\sum_{i=1}^{n} i^2 - 2\sum_{i=1}^{n} i + \sum_{i=1}^{n} 1\right)$$
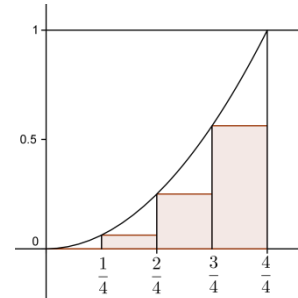
Tutor: As summation of a sum is equal to sum of summations, we obtain (the developments proceed):

$$= \lim_{n \to \infty} \left(\frac{1}{n}\right)^3 \left[\left(1^2 + 2^2 + \ldots + n^2\right) - 2\left(1 + 2 + 3 + \ldots + n\right) + \left(1 + 1 + 1 + \ldots + 1\right)\right] =$$

$$= \lim_{n \to \infty} \left(\frac{1}{n}\right)^3 \left[\frac{n(n+1)(2n+1)}{6} - 2\frac{n(n+1)}{2} + n\right] = \lim_{n \to \infty} \left(\frac{1}{n}\right)^3 \left[\frac{n(n+1)(2n+1)}{6} - n^2 - n + n\right] =$$

$$= \lim_{n \to \infty} \left(\frac{1}{n}\right)^3 \left[\frac{2n^3 + 3n^2 + n}{6} - n^2\right] = \lim_{n \to \infty} \left(\frac{1}{n}\right)^3 \left[\frac{2n^3 - 3n^2 + n}{6}\right] = \lim_{n \to \infty} \left[\frac{2n^3 - 3n^2 + n}{6n^3}\right]$$

$$= \lim_{n \to \infty} \left(\frac{2n^3}{6n^3} - \frac{3n^2}{6n^3} + \frac{n}{6n^3}\right) = \lim_{n \to \infty} \left(\frac{1}{3} - \frac{1}{2n}^0 + \frac{1}{6n^2}\right)_0$$

$$= \frac{1}{3}$$

Students: It is what we found: zero comma three, three, three, three, etc.

Tutor: Yes, zero comma three, three, three, … This sum here we call it as integral. We write: "integral, from zero to one, of the function *f* of x, delta x. In other words, integral of x squared, delta x." Mathematically, we write: Exact area

$$= \lim_{n \to \infty} \sum_{i=1}^{n} \Delta x f(x_{i-1}) = \int_0^1 f(x)dx = \int_0^1 x^2 dx \,.$$ This dx here is part of notation.

This presentation shows broad idea about how the experimentation was carried out. And so we present the conclusive remarks.

Conclusions

The experiment was very interesting for us. First it enabled to integrate computational media in the processes of teaching and learning mathematical concepts, in the case, definite integral. An experience we had never used before. Second, the integration of computer instrument (Rabardel 1995) promoted understanding the target concept as the refinement of a partition *P* of interval *I* was perfectly performed through the use of a computer. According to Labarre (2008) this process is a core idea of definite integral. The computer as an ostensive object, in terms of Chevallard (2002) and as an instrument, according to Rabardel (1995) allows to construct knowledge by student, if adequately integrated into usual practices as can be witnessed by students' interventions and their quality. It is worth to mention that the students' retrospective knowledge (Robert, 1986) on functions, sequences and their properties played a crucial role to successful teach and learn Riemann integral in computer environment. Finally we sum up our teaching and learning experiment in a scheme, the integrating scheme:

Integrating scheme on teaching and learning Riemann integral with help of computer
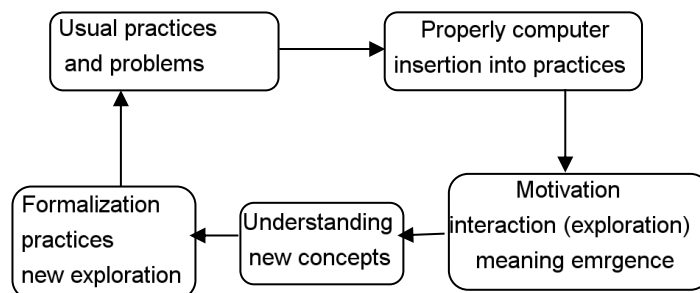
Figure 7

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UTILIZING NEW TECHNOLOGIES IN THE PREPARATION OF BUSINESS EDUCATION STUDENTS FOR SELF-RELIANCE

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Abstract
This study focused on utilizing new technologies in the preparation of business education students for self-reliance. The study is significant because unemployment has reached all-time high in Nigeria that universities are seeking better ways of preparing students so that they can have choices of employment, creating wealth or be useful to themselves after graduation. Descriptive survey research was adopted for the study. It was guided by two research questions and two hypotheses The population of the study consisted of 27 lectures and 266 students of the department of business and entrepreneurship education Kwara State University Malete and University of Ilorin, Nigeria. The structured questionnaire containing 30 items on a 5 point Likert scale was used to obtain information from the respondents. 293 questionnaires were administered to respondents and all were duly completed and returned and were used for the study. The data collected was analyzed using mean and standard deviation while t-test parametric test was used to test the hypotheses at 0.05 levels of significance. The findings revealed amongst others that utilization of new technologies by business educators in the preparation of business education students would be effective in making them self-reliant. One major recommendation was that new technologies should be effectively utilized to enable the graduates of business education to be creative and innovative.

Keywords: New Technologies, Business Education, Self-reliance and Higher Education

Introduction

Events in life take their natural course and life itself is full of changes. Change is a natural phenomenon which must come. Information and Communication Technology which is the umbrella name for new technologies is in vogue and will continue to improve as technology is the driving force in development issues across the world. Business education is a programme which prepares the youth for self-employment or for paid job. Therefore, it must follow new trends to bring up graduates who will occupy fit into the world of work. Education that will not equip the students for favourable competition is meaningless. Amiaya (2014) pointed out that new technologies have been found to possess the capacity to improve teaching and learning in the school classroom. This means that using new technologies in teaching and learning is the only adequate measure of training modern business education students for self-reliance.

The emphasis of the 21st century education is on the use of new technologies in the teaching and learning process. In Nigeria many schools are equipped with new technologies

irrespective of the fact that the nation is under developed. New technologies are provided so that the contemporary teacher especially business educators who teach skill courses for self-reliance would make use of these facilities to equip the students for the world of work, to be responsibly, proficiently, efficiently and effectively suitable for the modern business office and to be able to fend for themselves after graduation. Osuala (2009) stated that vocational and business education programmes have always provided for the needs of the society, by maintaining a high standard of manpower for the industries in the economy.

Technology has been changing the way people learn and interact for thousands of years. Johnson (2010) stated that innovations and inventions have encouraged the pace of social change throughout history, including education. Educators must prepare for a technology-rich future and keep up with change by adopting effective strategies that infuse lessons with appropriate technologies. This makes an authentic utilization of new technologies even more important. Training of business education students for self-reliance must keep pace with effective instructional technology use. This emphasis the need for educators at every level, to actively pursue professional development that enables a lifelong exploration of ways to enhance the teaching and learning of business education. Many researchers argue that major innovations or inventions, especially the Internet, adopted by society, have an effect on the structure of the human brain (Carr, 2011; Cardinali et. al; 2009; Doidge, 2007; Kurtzweil, 2005). They argued that there is little doubt that the Internet, through its networked and mobile functions, has changed the way that people find information and the way that they communicate. Therefore, if the structure of the human brain is changing due to new technologies such as the Internet, and locating information and communicating are changing, then changes to the way that students learn, and probably what they learn, would appear to follow. Education should follow the technological trend and use new technologies in teaching and learning because good teaching will always contribute to a student's development of general capabilities. This is one of the major issues and trends in business education. It is mandatory that new technologies should be utilized in preparing business education students if they are expected to actually be self-reliant.

Concept of Self-Reliance
Self-reliance is a compound word that is commonly used nowadays especially in business education. To be self-reliant is to rely on one's own capabilities, judgment, or resources; to be independent. Self-reliance is essential for job success, establishment and efficient management of personal business. Increase in unemployment has given the government, educators and individuals concern. Every aspect of education nowadays is directed towards giving the students the ability and skills that will make them have interest in self-employment. Changing the understanding of students towards paid jobs and encouraging them for self-employment can only be possible if the students are adequately trained with new technologies as this will give them the enthusiasm to try out their hands on new things. Self-reliance is the ability an individual has to establish a business of his own instead of working for another person. It is the ability to do or decide things by oneself. A person who is self-employed is said to be self-reliant. It is to be independent instead of working for another person. On the other, hand a self-relied person is an entrepreneur.

Atakpa (2011) in Agomuo (2005) stated that an entrepreneur is a person who sees a business opportunity, obtains the needed capital, knows how to put together an operation successfully and has the willingness to take personal risk of success or failure. Owenvbiugie and Iyamu

(2011) supported this view when they said that entrepreneurs are their own bosses, they make the decisions. They choose whom to do business with and what work they will do. They decide what hours to work, as well as what to pay and whether to take vacations. They offer a greater possibility of achieving significant financial rewards than working for someone else. It provides the ability to be involved in the total operation of the business, from concept to design and creation, from sales to business operations and customer response. It offers prestige of being the person in charge. It gives an individual the opportunity to build equity, which can be kept, sold, or passed on to the next generation.

New Technologies in Business Education
New technologies in Business education include the varied technologies used in teaching and learning process in business education. Amiaya (2014) supported this view when he said that new technologies are made of ICT and e-learning facilities presented by several tools like computers, internet and intranet, general system of communication, World Wide Web (www), teleconferencing and videoconferencing devices and mobile technologies. Technology has influenced what is being learnt in schools. Curriculum of business education has incorporated those contents that will allow students furnish themselves with the knowledge of the new technologies such as computer with its packages like the spreadsheet, database, Micro Soft World, Power Point, Webpage Design, Desktop Publishing, etc. Automated teller, word processor, the internet, reprographic machines, micrographic machines, accounting machines, modern telephone systems are all new technologies. In addition to desktop computers, we have laptops, wireless laptops, and tablet PCs. Also we have the World Wide Web, scanners, CD burners, USB drives, digital cameras and digital video cameras, PDAs, as well as video and DVD players. And most educators use a variety of tools-including video, e-mail, desktop conferencing, online programs such as WebTV and Blackboard, as well as video conferencing to teach. Thus, it is no longer acceptable for educators to be technology illiterate. This means that the new three E's of education are 'enabled', 'engaged' and 'empowered' which 'paints a picture of the learning process for students that is visually and structurally very different than which most students encounter in school today (Project Tomorrow, 2013). Furthermore, Resnick (2002) explained that students would need to be fluent online, with the web, text, audio, animation, video, remixing, design, downloading and uploading, and fluent in critical thinking, collaboration and deciding relevancy.

New technologies in business education are the modern facilities introduced into business industry to enable the business educator educate the learner to be proficient and profitable in the contemporary business world. The ways of using these modern facilities and packages in the class room teaching and learning processes in business education is a prerequisite for the preparation of business education students for self-reliance. Okwuanaso (2004) in Utoware, and Kren-Ikidi, (2013) posited that the more the changes in information and communication technology are occurring, the more new occupational opportunities emerge. He added that new occupational opportunities demand training and re-training that will enable the beneficiaries to meet the challenges of ever-changing skill requirements. Mohammed (2012) asserted that Information and communication technology (ICT) is the use of all forms of computer communication, network and mobile technologies to process information. Mohammed, maintained that computer technologies include all removable medias such as

optical discs, disks, flash memories, video books, multi-media projectors, interactive electronic boards and continuous emerging state of the art PCs.

Mobile technologies comprises of mobile phones, PDAs, Palm tops etc. The technologies have information as their material object which is used in teaching and learning. According to White (2013), it is important to remember that the pervasiveness of digital technology will be necessary for a lifetime in moving beyond information-centric views of education to practical and creative knowledge for the preparation of students for adequate competition in the modern business office There is no doubt that digital media and the Internet have changed the way that people access information and communicate with one another. The Internet is so prolific that it has become a global phenomenon. Howard (2011) argued that, as a society, we need to decide what sort of society we want and what sort of people we want. He further maintained that these apparently simple questions are quite profound for education in the sense that decisions about what people learn and how people go about engaging with one another, in order to learn, come to the fore. The social institution of education may be society's answer to these questions.

Business education should be focused on the Partnership for 21st Century Skills as these are the issues and trends of the 21st century education. It should be able to target to make the students fit into the current technological trend by adequately using new technologies in the classroom teaching and learning so that the graduates will not be a misfit in the society.

Statement of the problem
The world is technology driven and the introduction of new technologies has changed the way things were done even in the classroom teaching and learning. The traditional methods of pedagogy which focused on the teacher pouring knowledge on the learner has given way to the child-centred learning method where the students are expected to discover learning using new technologies. The content and pedagogy are no longer sufficient in a digital world because there is now a technological dimension for accessing information and for communicating which the students need to know. The question remains about how business education can change existing teaching practice to utilize technological, pedagogical and content knowledge. Teachers need to embrace new technologies to become fluent in the use of digital technologies for teaching in the digital age. The aim of teaching and learning using new technologies is focusing less on paid job and more on self-reliance. The new technologies which encompass all the modern ICT facilities should be skillfully utilized by business educators in preparing the students for self-reliance. Where this is not so the students seems to be wasted and the years of schooling also wasted. According to Adiole and Igboanugo (2012) in Nwachukwu and Mahmud (2013) technology has changed the content, nature, procedure, tools and practices of virtually every human endeavor. They maintained that these changes cannot be ignored as no nation, profession or even person can expect to develop in this technological era without making attempt to follow the trend of technology. If this is the case then what are the consequences of not utilizing new technologies in business education in the preparation of students for self-reliance?

Purpose of the study

The major purpose of the study was utilizing new technologies in the preparation of business education students for self-reliance.

Specifically the study was carried out in order to:

1. Determine the new technologies that can be utilized in the preparation of business education students for self-reliance.
2. Ascertain the benefits of utilizing new technologies in the preparation of business education students for self-reliance

Research Questions

1. What are the new technologies that can be utilized in the preparation of Business Education students for self-reliance?
2. What are the benefits of utilizing new technologies in the preparation of business education students for self-reliance?

Hypotheses

The following null hypotheses was formulated and tested at 0.05 level of significance

1. There is no significant difference between the opinion of lecturers and that of the students regarding the new technologies that could be utilized in the preparation of business education students for self-reliance.
2. There is no significant difference between the opinion of lecturers and the students regarding the benefits of utilizing new technologies in the preparation of business education students for self-reliance.

Method

The descriptive survey research design was adopted for this study. A survey research design is one in which group of people or items are studied by collecting and analyzing data from only a few people or items considered being representative of the entire group with the intention of using the data to justify current conditions of the studied phenomena. The area of the study are Kwara State University, Malete and University of Ilorin, Nigeria.

Population

The population of the study consists of business education students and lecturers in universities offering business education in Kwara State. The universities are University of Ilorin, Kwara State University and Al-Hikmah University, Igbaja.

Sampling Technique

All students and lecturers totaling 293 and 27 respectively in Kwara State University and University of Ilorin which are public universities were studied. Al-Hikmah University being a

private university was left out because business education programme was recently introduced and has not been accredited by National Universities Commission.

Instrument for Data Collection

The instrument for data collection was a questionnaire with 30 items structured on a 5-point rating scale of Strongly Agreed, Agreed, Undecided, Disagreed and Strongly Disagreed with values of 5, 4, 3, 2, and 1 respectively. The questionnaire was divided into two sections A&B, to answer questions regarding the new technologies that could be utilized and the benefits of utilizing these technologies in the preparation of business education students for self reliance. The instrument was validated by two experts from the Department of Business and Entrepreneurship Education Kwara State University, Malete. The reliability of the instrument was tested to ascertain the internal stability of the questionnaire items and a reliability index of .89 was realized. The Research Questions were answered using mean and standard deviation. Any mean score of 3.00 and above was accepted while any mean score below 3.00 was rejected. The student t-test statistics was used in testing the hypotheses.

Results

Research Question 1

What are the new technologies that could be utilized in the preparation of Business Education students for self-reliance?

Table 1: Mean rating and standard deviation of–lecturers and students on new technologies utilized in the preparation of Business Education students for self-reliance.

S/No	New Technologies	X	SD	Remarks
1.	New technologies are modern ICT Facilities used in teaching and learning in business education.	4.35	.42	Agreed
2.	Computers and projectors are used in teaching and learning in this technology era.	4.40	.68	Agreed
3.	Teaching in this digital age requires MP3 tablets and Smartphone.	4.05	.56	Agreed
4.	Most educators use a variety of tools such as video, e-mail, desktop conferencing, online programs and interactive whiteboard to teach in this technology age.	3.83	.37	Agreed
5.	Wireless classroom, microphone, mobile devices are new technologies in business education	4.44	.88	Agreed
6.	Internet with all of its variations e.g. email, YouTube, Facebook, are new technologies	3.41	.49	Agreed
7	Class blog and wikis should be used in this technological age in teaching and learning	4.58	.73	Agreed
8.	Multimedia fluency is required by business educators in this technological age	4.91	.28	Agreed
9.	IPod, CD ROM, DVD, Modem, Laser printer are new technologies	4.87	.39	Agreed
10.	Web, text, audio, animation, video, remixing, design, downloading and uploading, and fluent in critical thinking should be some of the qualities that can be by business educators in preparing students for self-reliance	4.91	.28	Agreed

11.	Digital cameras, digital video cameras and Digital scanners are useful in the preparation of students for self-reliance.	4.97	.14	Agreed
12.	Smart board, World Wide Web, CD burners, USB drives, are new technologies.	4.93	.32	Agreed
13.	E-learning, PDAs, as well as video and DVD players should be used in the technological classroom.	4.64	.73	Agreed
14.	Business educators should use WebTV and Blackboard, as well as video conferencing to teach .	4.84	.47	Agreed
15.	Skype should be used sometimes to teach so that distance would not be a barrier to teaching and learning._	4.75	.52	Agreed
	Grand Mean 4.50			

The results in Table 1 indicated that all the respondents agreed with all the 15 items that the new technologies mentioned in the questionnaire should be utilized in the preparation of business education students for self- reliance.

Research Question 2

What are the benefits of utilizing new technologies in the preparation of business education students for self-reliance?

Table 2: Mean rating and standard deviation of lecturers and students on benefits of new technologies utilized in the preparation of Business Education students for self-reliance.

S/No	Benefits of utilizing new technologies	X	SD	Remarks
16.	E-learning tools reinforce learning and mastery of the application of knowledge gained.	5.0	.00	Agreed
17.	New technologies encourages students participation in the classroom teaching and learning.	4.64	.73	Agreed
18.	Learning is better discovered when using new technologies.	4.61	.68	Agreed
19.	New technologies in teaching and learning makes teaching and learning more effective.	4.82	.53	Agreed
20.	It enhances their knowledge of the global society.	4.80	.47	Agreed
21.	New technologies enable learners to develop global competence .	4.84	.42	Agreed
22.	It gives students opportunity to learn and see new places.	4.90	.45	Agreed
23.	Possesses the capacity to improve teaching and learning.	4.85	.43	Agreed
24.	It provides students with opportunities that make it easier for them to operate in this digital age.	4.98	.10	Agreed
25.	There is no classroom demarcation because learning can take place any time irrespective of the location of the teacher and the students.	4.44	.88	Agreed
26.	It equips them with skills required for survival in the modern business office.	3.83	.37	Agreed
27.	Users can set up internet business after graduation.	3.86	.86	Agreed
28.	It helps them not to be a misfit in the contemporary office .	3.62	.48	Agreed
29.	It enables the teacher meet the needs of every student.	4.64	.73	Agreed
30.	Enhances learners understanding concerning the business environment.	4.76	.68	Agreed

Grand Mean 4.60

The data presented in Table 2 revealed that all the respondents agreed that there are benefits in using new technologies in the preparation of Business Education students for self-reliance with a mean score of 5.00 and 3.83 respectively.

Results of the test of hypotheses

Ho_1: There is no significant difference between the opinion of lecturers and that of the students regarding the new technologies that could be utilized in the preparation of business education students for self-reliance.

Table 3: Student t-test result on the opinion of lecturers and students regarding the new technologies that could be utilized in preparation of business education students for self-reliance.

Variables	N	X	SD	DF	α	t-cal.	t-crit	Decision
Lectures	27	3.72	.27	29	0.05	1.284	0.205	Rejected
Students	266	4.90	.45					

The table 3 above showed that the calculated value of t was 1.284. The t-critical value was 0.205 which is greater than the fixed p-value of 0.05 (p<0.05). Therefore, the null hypothesis which stated that there is no significant difference between the opinion of lecturers and students regarding the new technologies that could be utilized in the preparation of students for self-reliant was rejected.

Ho2: There is no significant difference between the opinion of lecturers and the students regarding the benefits of utilizing new technologies in the preparation of business education students for self-reliance.

Table 4: Student t-test result on the opinion of lecturers and students regarding the benefits of new technologies that could be utilized in preparation of business education students for self-reliance.

Variables	N	X	SD	Df	α	t-cal.	t-crit	Decision
Lectures	27	3.86	.17	291	0.05	1.78	0.081	Rejected
Students	266	4.85	.33					

The analysis in Table 4 showed that at 0.05 level of significance, t-calculated of 1.78 was greater than the t-critical of 0.081, therefore the null hypotheses which stated that there is no significant difference between the opinion of lecturers and the students regarding the benefits of utilizing new technologies in the preparation of business education students for self-reliance was not upheld.

Discussion of Findings

The data presented in table 1 provided answers to research question one by agreeing that new technologies should be utilized in the preparation of business education students for self-reliance. It indicated the acceptance of both lectures and students in the new technologies that could be utilized in the preparation of business education students for self-reliance. The findings agreed with the works of Amiaya (2014) and Mohammed (2012) that new technologies include all removable medias such as optical discs, disks, flash memories, video books, multi-media projectors, interactive electronic boards and continuous emerging state of the art PCs. Mobile technologies comprises of mobile phones, PDAs, Palm tops etc. Technology has been changing the way that people learn and interact for thousands of years this was also in agreement with the work of Johnson (2010) which stated that innovations and inventions have encouraged the pace of social change throughout history, including education. This revealed that teaching and learning in this technology age requires all the ICT facilities to be able to give the learner the required education of the time.

The results of Table 2 found that there is the need to utilize new technologies in the preparation of business education students for self-reliance as the knowledge of these technologies enhances their understanding of the business environment in the digital age. It also revealed that it is the only means of given the students the right learning which would benefit them in this digital age. This finding was in consonance with the study of Osuala (2009) which reported that vocational and business education programmes have always provided for the needs of the society, by maintaining a high standard of manpower for the industries in the economy.

The importance of issues and trends relating to the use of new technologies in the preparation of business education students for self-reliance cannot be overemphasized as there is no way the youths could be useful in this digital age without adequate knowledge of these technologies. The trends of using new technologies in teaching and learning in the 21st century education is very important because that is the only means of enabling the graduates to be self-relied and not only being self-reliant but will also be employers of labour thereby reducing unemployment in the country. The benefits accrued to utilizing new technologies in the preparation of business education students for self-reliance is worth pursing as revealed by this paper.

Conclusion

New technologies are in vogue, the digital age requires that knowledge, skills and attitudes be utilized in order to harness the 21st century teaching and learning which is digital in nature. The Utilizing of new technologies in the preparation of business education students for self-reliance is very important because that is the only way of enabling the youths to be creative and innovative in this age.

Recommendations

Based on the investigations carried out by this research study the following recommendations are made:

Business Educators should utilize new technologies because using new technologies in teaching and learning is the only effective and efficient training in this digital age.

It is imperative for business educators to retrain and update themselves and their skills on the new technologies in business education.

The laboratories, studios and workshops of every business education department should be equipped with new technologies to suite the technological need.

New technologies should be adequately provided and effectively utilized to enable the graduates of business education be creative and innovative.

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MOBILE SOCIAL NETWORKING FOR CRITICAL CITIZENSHIP: USING FACEBOOK MOBILE TO TEACH COMMUNITY ENGAGEMENT AT A SOUTH AFRICAN UNIVERSITY

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Abstract
The uptake of students on mobile social networking (MSN) for the micro-management of their academic lives has been met with educators' disproportionate and often erratic appropriation of this social practice for academic purposes. The creeping pace of the adoption of mobile social media (MSM) in higher education can be attributed to educators' limited conceptualisation of how to integrate MSM into their pedagogy. This study examines the potential of Facebook mobile to mediate university educators' teaching as community of practice to foster creative and critical engagement among students. A case study of a Global Citizenship course at an elite South African university, which employed Facebook mobile forums to foster peer-based engagement is employed to explore the potential of MSN to enhance community engagement and transform pedagogy. This research address the following question: How do educators and students employ mobile social networking to mediate their practical teaching and learning of community engagement and critical citizenship? Data mining was employed as the data collection method. The findings suggest that Facebook mobile forums can constitute self-sustaining, affinity and deliberative spaces for student articulation of community engagement discourses. Although these forums enabled the systematic integration between Web-based environments and traditional instruction, the need to research more cognitive framework to enhance students community engagement with regards argument building and developing scholarly discourses is necessary.

Keywords: mobile social networking**,** community engagement, Facebook mobile, critical citizenship, mobile social media

Introduction

Social network demographics is a highly contested subject and statistics are reported differently ranging from the number of users' hits per day, number of active accounts and number of users on a social network (Volkova,2015). Facebook's base of users continues to be very active, 70% of the people engage with the site daily (and 45% do so numerous times a day) and there has been an increase of 63% of who did so in 2013 (Duggan, Ellison, Lampe, Lenhart, & Madden 2015). From a demographic point of view, an equally significant finding is that, total number - of 11, 8-million South African users – 22% of the population – 8,8-million access it on their mobile phones. This means that targeting Facebook users is not a matter only of marketing on the Facebook web site but – its mobile properties are probably more important" (World Wide Worx, 2015). Undoubtedly, the uptake of social media in South Africa coincides with a surging appropriation of mobile phones due to the more convenient, personal access to social networking via mobile phones than desktop computers. More so, Rambe (2012) posits that an increasing number of smartphones on the South African market come preloaded with social-media applications such as Facebook which allow convergence between social networking and mobile learning. As such, the use of social

media-enhanced phones enables the convergence of the social, media and technology dimensions to render unprecedented learning experiences for students in South African universities (Traxler & Ng'ambi, 2012).

Mindful of their communicative and social networking potential, social networking sites (SNS) which are accessible via mobile social networks present immense opportunities for South African universities to extend their community engagement mandate in support of community empowerment and leveraging their social responsibility for these communities. The Staffordshire County Council Community Engagement Framework (2010) defines community engagement as: "The actions that agencies [and individuals] take to enable them to consult, involve, listen and respond to communities through ongoing relationships and dialogue. In the context of learning, community engagement entails initiatives and processes through which the expertise of the institution in the areas of teaching and research are applied to address issues relevant to its community (Council on Higher Education (CHE), 2004). Council on Higher Education (2004) elaborates that community engagement typically finds expression in a variety of forms, ranging from informal relatively unstructured activities to formal and structured academic programmes directed at particular community needs, and some projects might be conducive to the creation of a better environment for community and others might be directly related to teaching and research. Community engagement as a form of political participation should be tied to a transition from student political awareness of their rights to participate in change oriented processes towards authentic, practical social action that positively impacts underserved communities.

Mindful of their profoundly dialogic nature and their constitution as forces for bonding self-identifying student affinities around mutual interests, mobile social networks present potentially powerful discursive tools for fostering community engagement in South Africa, a caste society that continues to be plagued by the inequalities of the apartheid legacy. Despite their potential to render enduring change to underserved communities, mobile social networks' capacity to promote students teacher engagement as community of practice has not been sufficiently explored in academic literature.

This paper, therefore, explores the potential of mobile social networking to mediate student articulation of community of practice - engagement discourses in support of critical citizenship.

Critical citizenship

Critical citizenship is a highly controversial subject and its deployment evokes multiple meanings ranging from critical consciousness or critical application of the mind (Dam & Volman, 2004, Osler, 2000, Seddon, 2004) democratic disagreements that result in the rebuilding of communities, mending of social fractures and redressing of injustices (Bickmore, 2005) and service learning (Henning, 2011). A 'critical' approach [to citizenship] is stepped in the making of informed choices about impactful change, providing justifications of these choices, respecting diversity of views, their communication and in the process reflexively applying ones' mind (Dam & Volman, 2004). Critical citizenship is also conceived to directly relate to critical pedagogy, which stresses the dynamic, fluid and intricate connections between society and citizenship (Moore, Gegieckas, Marval, McCauley, & Peloquin, 2011) in the shaping of political engagement.

Approaches to critical citizenship rooted in political activism transcend the mere involvement in political movements and communities to encompass "critical notions of social agency to expand the meaning and purpose of democratic public life and its connection to higher education" (Giroux, 2003). It demonstrates the efficacy of students, as researchers and political actors to imprint lasting change through their activities that translate cogitative processes into citizenship actions. The public's actual capacity to influence public decision making and to transform the political landscape of marginalized communities is intricately connected to their sense of efficacy in the public policy making domain. Such expression of citizenship democracy find expression in the youthful vote that catapulted President Obama to power in 2008, the Arab Spring that toppled regimes in the North Africa and the Middle East and self organised non-partisan vote mobs (Moore, Gegieckas, Marval, McCauley, & Peloquin, 2011).

Community of practice engagement role of the modern university

Multiple discourses on the community practice engagement role of educational institutions have flourished. These range from active participation in democratic decision making affecting communities (Weinrib 2008, Luescher-Mamashela et al, 2011); service learning in support of civic engagement and civic responsibility (Henning, 2011); responsible leadership (MacKinnon & Gardiner, 2009) and critical citizenship. The discourses on active participation of universities in communities are often tied to the social development arguments, where political involvement is a means to an end-social advancement of society through the meeting of its social needs. These needs could include but are not limited to eliminating illiteracy, ameliorating poverty, overcoming disadvantage and provision of other life necessities. These discourses are located in volunteerism and service learning. From a university perspective, Badat (2009) argues that at different moments, in differing ways and to differing degrees, community engagement has encompassed community outreach, student and staff volunteer activities and 'service-learning.'

Collison (2013) highlight four pillars to effective community of practice engagement as promoting:

1. A shared concern or passion and the level of concern or passion will have a huge impact on the way in which people give discretionary time to the group.

2. A shared practice involves some time well spent, and groups should consider creating and regularly updating a self-assessment or maturity model which describes their particular practice. This helps them to agree upon the important topics, agree upon what good looks like and identify where they can share and learn from and with each other.

3. A commitment to learning- there should be a relationship between "lessons learned" and the community. It also involves the ownership of this learning process, and agreement to maintain a knowledge asset or product, which represents the community's most current thinking and understanding.

4. A commitment to interact regularly- it is good to agree upon how the community plans to interact and review regularly how effective their interaction is.

Community of practice engagement using mobile social media technologies

Sokol (2011) reports on how International relief organisations, American Red Cross and The Clinton Global initiative are employing mobile phones and social media applications to channel relief aid services to disaster stricken areas. After the aftermath of Hurricane Ike, these organisations appropriated Tele-health technology, which involves physicians' use of mobile phones, to provide important health care services to patients in remote consultations and reduce patient load on local facilities in disaster prone areas. ICT Statistics Newslog (2010) provides how text messaging serves as a useful tool for promoting personal health care and encouraging patients with type 2 diabetes to adopt more healthful lifestyles. Through text-based chats and online chat rooms moderated by a medical practitioner, peer-support groups are created that provide some emotional and psychological support and reduce a sense of seclusion among patients. Student Community Engagement describes the wide range of activities that help to bring students together with the local community. Bandy (2016) student community engagement is a form of experiential education where learning occurs through a cycle of action and reflection as students seek to achieve real objectives for the community and develop deeper understanding and skills for themselves. In the process, students link personal and social development with academic and cognitive development. In this process, experience enhances understanding; understanding leads to more effective action.

Theoretical Framework

Given this paper's focus on exploring the potential of mobile social networking to mediate student articulation of community engagement discourses, a theory that unravels the cultural dynamics (contexts, discourses, social repertoires, social practices, habits) and organic development on online communities in situated cultural contexts would render conceptual and analytical lenses for investigating this complex problematique. With its focus on domains, practices, communities and different forms of participation, Community of practice (CoP) perfectly fitted this investigative task. Located at the intersection of situated learning and constructivism, CoP rejects a determinist view of networked technology and embraces its social embeddedness-its value, downsides including the ambivalences that accompany its use.

Community of Practice Engagement

Communities of practice (CoP) denotes "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an on-going basis" (Wenger, McDermott, & Snyder 2002). It articulates how practitioners (in collaboration with novices) mutually share their expertise, knowledge (tacit and explicit), repertoires and experiences through engagement in their professional (/academic) practices. Since CoP engagement discourses involve academics, students, their peers, and communities who adopt mobile social media to collaboratively share their common concerns about overcoming prejudice, disadvantage and poverty, and who commit their expertise and professional knowledge to their redress, CoP best suited this investigation.

For Bentley, Browman and Poole (2010), the aforementioned definition from Wenger et al. (2002) captures three structural elements of a CoP namely, its *domain, practice*, and

community. For Wenger (2004), the *domain* depicts "the area of knowledge that brings the community together, gives it its identity, and defines the key issues that members need to address." It constitutes the problem area or area of members' overlapping expertise, and it provides the initial centripetal pull uniting individuals who might otherwise work in separate organisational units, disciplines or locations (Bentley, Browman & Poole, 2010). The domain, therefore, stirs community members in a given direction and provides them with a unified purpose and unique professional identity. In the current study, community engagement constituted the domain in which students participated and contributed knowledge. From it emerged broad themes like global warming, international politics, and environmental protection. Engagement in the domain within a university contexts would underline students working together to solve academic issues in their discipline that need their attention and assisting each other to develop an understanding of these issues.

The *practice* denotes the "body of knowledge, methods, tools, stories, cases, documents, which members share and develop together (Wenger, 2004). In the current study, this knowledge ranged from political empowerment, poverty eradication, autonomous development, environmental conservation among others. Engagement in practice in a university context would entail students sharing knowledge, methods, and stories to deepen their learning.

Community denotes a set of interpersonal relationships arising out of people's mutual engagement in learning through practice (Bentley, Browman, & Poole, 2010). In this study community comprises academics, students, their peer members on Facebook mobile, the volunteer organisations they were attached to during community service, including the university divisions dealing with community relations. Engagement in community in a university context would mean students building social and academic relationships that help them reach out to their community (academics, peers, extended university community) and building work teams that deepen their learning.

Objectives of the study:
1. To explore how lecturers employ mobile social networking to mediate their practical teaching through community of practice engagement discourse.

2. To interrogate how students employ mobile social networking such as Facebook mobile to enhance their learning.

Research Questions
This research addressed the following questions:
- How do lecturers employ mobile social networking to mediate their practical teaching through community of practice engagement discourse?

- How do students employ mobile social networking such as Facebook mobile to enhance their learning?

The research method

The Case Study
Programme Description
A case study of a Global Citizenship: Leading for Social Justice (GC-LSJ) programme at an elite South African university was used for this investigation. The GC-LSJ programme had two main overarching goals namely, the fostering of engaged citizens on global issues and developing practically oriented action (social activism) to entrench social justice in local communities. The programme comprised over 200 students registered across the 2 modules (70:45 split Module 1 and 2) (Higher and Adult Education Development Unit, 2012).

The programme sought to:

- Promote deep student engagement with critical citizenship and social justice by making learning more experiential through service learning in addition to critical enquiry of concepts, issues and constructs.

- Foster responsive leadership among university graduates through its prioritisation of realistic, pragmatic interventions for confronting deprivation and social injustice.

- Nurture experience (past and present) and knowledge of volunteering as levers for transforming local communities and realising social justice.

The Programme had two Modules: *Global Debates, Local voices* and *Thinking about volunteering: service, boundaries and power*, which were both anchored in critical scholarship on global issues and execution of social justice as well as giving students practical experiences in contributing and impacting communities. Module 1 dealt with the following themes: *Debating Development; War and Peace; Climate Change, Africa in the Globalised world* and *Volunteering and service*. Module 1 emphasised inter alia, student engagement with global debates, reflection on prior personal experiences of developmental issues, volunteering and service, participation in collaborative learning activities, critical questioning practices and constructions of new knowledge drawing on learned content/experiences.

Module 2 comprised the following themes: *Self and service*, *contexts of inequality*, *the ethics and paradigms of service*, *development and sustaining new insights*. For this module, students drew on their prior and present experience of volunteering to effectively serve their communities, critically reflect on constructs and issues, as well as write reflective papers.

Module 1 activities

To render knowledge-centred learning environments, students were expected to participate in reflective seminars, Facebook group forum, write blog postings and chats, write tasks based on identified themes, participate in learning events and contribute to opening and closing discussion sessions. Since the focus of this investigation is the mediating potential of social media, Facebook discussion forums alone will be the focus of this investigation. Module 1 activities sought to promote:

❖ Student identification of local communities' needs / challenges and formulate appropriate interventions to redress them,

❖ Meaningful participation in collaborative learning activities like watching brief films and animations on community engagement.

❖ Critical questioning practices (posing, responding to and interpretation of questions) that prompted student construction of their own knowledge and interpretations drawing on learned content/experiences.

Module 2 Activities

In Module 2, students were expected to draw on their prior and present experience of volunteering work in partnership with local organisations within the university and volunteers in the sharing of knowledge and experiences. They also sought guidance from these organisations to develop the social capital necessary for effectively serving the communities. The learning activities included:

- 15 hours of community service,
- 12 hours of reflective face-to-face sessions,
- 2 short reflective papers, and
- Self-reflection in blogs and commenting on peers' blog posts.

Data collection tools

Data mining

These undergraduate and postgraduate students drawn from diverse faculties at the university were expected by their educators to post messages to the GC-LSJ Programme Facebook group forum (public wall) using their desktop computers or mobile phones. Since the university prohibited students' access to social media from library work stations and computer labs, many students opted to access their Facebook accounts from their mobile phones (that is Facebook mobile).

Since the current study focused on social media networks ability to mediate community engagement discourses between students and educators, the researcher was authorised by the GC-LSJ team to download all Facebook group forum postings for in-depth analysis. After downloading these artefacts, he printed them to understand the interactants' cogitative processes on community engagement.

Presentation of data

Descriptive statistics
At the end of the GC-LSJ programme that lasted two semesters, student postings /discussions were mined, printed and counted to determine their frequencies (See Table 1). About 200 students enrolled for the GC-LSJ programme and of this number only 41 students participated on the programme's Facebook page, representing a participation rate of 20.5%.

Table 1: Frequencies of the themes discussed on Facebook mobile forum

Theme	Number of postings	Percentage
International politics news (e.g., popular uprisings)	10	9.52%
Human rights violations	6	5.71%
Global interventions	3	2.85%
Collective civic action	17	16.19%
Social justice and equity	9	5.57%
Climatic change debates	13	12.38%
Enhancing critical social awareness	11	10.47%
Personal branding	2	1.90%
Natural disasters	3	2.85%
General announcements	31	29.5%
Total	105	100%

Using thematic analysis, the Facebook mobile forum was closely searched to understand the main themes that educators, students and peers discussed. As shown in the Table 1, 10 themes were discussed. Although not every one of these themes incited some debate, some themes (like popular uprisings and human rights violations were more perceptively emotional than others). Given that the focus of this investigation is exploring the mediating role of Facebook mobile in academic engagement, the focus was less about unravelling the occurrences of each theme in Table 1 and more about how different forms of engagement played out in the Facebook mobile forums.

Qualitative analysis using CoPE and community engagement concepts

After counting the occurrences of each theme on the Facebook mobile forum, these themes were put in conversation with Wenger's (1998) Community of Practice (CoP) and community engagement concepts to make sense of how social media networks mediated community engagement discourses. The community engagement categories were adapted from the Staffordshire County Council (see Table 2 Below).

Table 2: Community Engagement Framework

Community of Practice Concepts	Type of Engagement	Description	Example
Domain	Information	Keep people informed about what is going on	According to a new report published by the United Nations Food and Agriculture Organization, the livestock sector generates more greenhouse gas emissions as measured in CO2 equivalent − 18 per cent − than transport. It is also a major source of land and water degradation. How does meat contribute to greenhouse gases???. (Student posting). On the climate change article; as people rightly point out weather & environmental fluctuations

			happen all the time and floods & droughts aren't new. But climate change affects these patterns; every few years SA has a bad drought in the centre of the country which is perfectly natural. What climate change is doing is moving these fluctuating droughts further east, making them more widespread and more intense. It does not cause natural disasters (Educator's posting) .
Practice	Consultation	Seeking people's opinions about a document, idea or policy	Thomas Sankara - The Upright Man Part 1 www.youtube.com Synopsis: Thomas Sankara rose to power in a popularly supported coup in 1983 and renamed his country to Burkina Faso, "Land of Upright Men" and launched the ...A different kind of African leader?? (Peer posting) Definitely a different kind of African leader. Not a puppet of Europe like some leaders we see today. Although his ideologies were not perfect, we do need someone with the courage that Thomas Sankara had. Thanks for the link (Peer's response)
	Involvement	Seeking views, ideas or opinions and using them to inform or make decisions	Meat Free Monday: don't forget to play your important role in fighting global warming. be a vegetarian for only 24hours and make a positive change (Student posting). By giving up meat for one day each week you can save money, reduce your environmental impact and live a healthier life. I think meat-like vegetarian products are a grey area, I'm sure many additives go into them as well (Student response)
Community	Acting together	Local people and public organisations working together to carry out work or run parts of a service	If you agree that South Africa's current response to climate change is ineffective and leaves much to be desired and that we need a stronger and more effective South African response to climate change, sign the petition at: Cleaner Climate Campaign - The Petition Site www.thepetitionsite.com (Student posting)
	Supporting independent community initiatives	Helping the local community to do what they want	Dennis Hong: Making a car for blind drivers	Video on TED.com TED Talks Using robotics, laser rangefinders, GPS and smart feedback tools, Dennis Hong is building a car for drivers who are blind. It's not a "self-driving" car, he's careful to note, but a car in which a non-sighted driver can determine speed, proximity and route -- and drive independently (Student).

(Adapted from Staffordshire County Council Community Engagement Framework 2010, p. 4)

Presentation and discussion of findings

Connectivist strategies to build on student's knowledge
To address the question on how educators (Programme Head, course convenor) and students employed mobile social networks (Facebook mobile) to mediate their teaching and learning of community engagement, the study first sought to understand how educators' pedagogy was framed and informed by mobile social networking. The role of the teacher in a community engagement context is to be an information provider, role model, a facilitator, an assessor, a planner and a resource developer (Harden and Crosby, 2000). In the same vein, students should be active participants in community engagement endeavours, students should be empowered to pose questions or express their own ideas about a subject, be motivated about their learning and be task monitors (The role of student in the classroom, 2009). The educators employed connectivist teaching strategies that drew on existing student mobile social networks to build on student knowledge about community engagement and critical citizenship. For Siemens (2006) connectivism conceives learning (defined as knowledge patterns on which we can act) to reside outside of humans (within an organization or a database) and it foregrounds connecting specialised information sets enabling knowledge seekers to learn more than their current states of the mind. Educator's connectivist pedagogical strategies therefore, involved:

- Provision of relaxed delegated authority to tutors who moderated and engaged with student contributions to the Facebook mobile forums.

- They promoted peer-based coaching on Facebook mobile by encouraging students to engage amongst themselves to render a sense of ownership of Facebook forum discussions.

- They occasionally contributed invaluable background information and resources that would cognitively scaffold student knowledge about community engagement and critical citizenship concepts. These included videos, pictures and animations on topics like the importance of active citizenship for participative democracy.

Domain: Information sharing
The domain is the research area around which practitioners and novices converge in the course of working and sharing their knowledge. The problem areas around which students shared their knowledge, information and expertise were community engagement and critical citizenship. From these two knowledge domains emerged the discourses that were tied to the ten themes identified in the quantitative analysis in Table 1. The goal of sharing domain knowledge was mainly to inform peers about concepts or issues (see the next paragraph).

Informing and coaching peers about climatic change and civic engagement

Under the theme climatic change, students engaged in critical dialogue about raising critical consciousness and awareness about global issues like climatic change. While all the ten themes discussed qualify to be considered under sharing of domain knowledge category,

climatic change debates where more dominant and hence deserve more attention. In conjunction with the service learning activities they engaged in under the supervision of voluntary support organisations, students also used the Facebook mobile forum to reflect on climatic change discourses learnt in class.

While these informative postings suggest the sharing of peer-based and lecturer knowledge on the current interventions, they tended to be fragmented and lacked cohesive analysis. Often, these engagements did not foreground particular central issues or invite well-coordinated argumentation and informed peer critique. While the limited critique and substantiation of arguments were often typical of "unsupervised" social networking debates, increased tutor support could have improved the quality of the debates.

Practice: Consultations
In CoP, practices emphasises the personal, often unverbalised body of knowledge that the practitioners and novices want to share and build on. as Amin & Roberts (2008) suggests, [social] practices involve "implicit relations, tacit conventions, subtle cues, untold rules of thumb, recognisable intuitions, embodied understandings and shared world views." in this study, students used the mobile social networks to share views and perspectives, assigned learning tasks, news of latest events, stories and ways of knowing about their communities and critical citizenship.

Seeking people's views about governance issues

Educators also employed mobile social networks as spaces for promoting political awareness and conscientisation about international political affairs. Students posted some comments that solicited public opinion (peers, senior students and the general academic community) on particular contentious political issues to influence one another's psychology. For instance, some innovative students downloaded topical videos on You Tube and streamed them into the Facebook mobile discussion page for public comments and feedback. One of these politically inspired videos included Thomas Sankara's ascendency to power and his resistance of Western imperialism and domination:

Practice: involvement
The sharing on social practices on Facebook mobile also involved seeking peer views, ideas or opinions and using them to inform or make decisions. Student used their personal opinion and perspectives not only to engage in some personal branding but also to influence public decision making about issues like global warming and climatic change.

Seeking peers' views and using them in decision making

Student employed Facebook mobile as a political platform to raise their opinions about political issues and to build discursive coalitions on issues of public concern. For example, they shared their views on the clean climate campaigns and encouraged their peers to sign a petition on the matter:

Apart from raising political consciousness through a mobile social network, students also reinforced personal branding on Facebook mobile and canvassed their peers' buy-in to their individual ideologies. Through moral suasion, they enticed or co-opted their peers to refrain

from meat foods as a way of cutting down on the carbon gas emissions from animal meat. The first posting below is indicative of this:

Community: Acting together
Appreciating the mutual engagement inherent in a community, Wenger, McDermott and Snyder (2002), contend that community creates the social fabric of learning through interactions and relationships based on mutual respect and trust. Through their collective engagements, educators and students expressed their willingness to share ideas, expose each other's ignorance in certain areas and engage with difficult questions.

People and public organisations working together

Students employed Facebook mobile to share news about newly formed organisations that supported youth empowerment and to share their political convictions. They also enticed their communities to join these organisations or group formations and to share their own views in these organisations.

The intention of these student postings was to use Facebook mobile to introduce and socialise their peers into different social formations that would improve their active participation in community engagement processes and their decision making processes about under-served communities.

Supporting independent community initiatives

Students also shared inspiring community initiatives that they expected their peers to rally behind in their community building aspirations.

Although these posts point at students desire to establish learning communities around their shared community of practice, their challenge, however was the lack of in-depth engagement with peer and lecturers' postings beyond just posting individual messages.

Discussion
Mobile social networks mediated discourses on community engagement and critical citizenship in five main ways which are:

- Raising political consciousness about latest global issues,

- Generating political opinions and perspectives about political affairs,

- Influencing and shaping mobile Facebook users' psyche and decision making about community engagement issues,

- Supporting community development initiatives

With regard to imparting political consciousness, mobile social networks were useful vehicles for communicating political messages among student community engagement who would

otherwise not meet physically to discuss their political views and perspectives because of their engagements in the field (service learning). This finding coheres with literature. Robertson, Vatrapu & Medina (2010) demonstrate how social networking sites like MySpace have been deployed by American presidential candidates for advancing democratic discourse. Their study report on how political candidates have appropriated these sites for collecting funds disseminating messages, creating groups with political affiliations and initiating collective activities.

Student also appropriated Facebook mobile to generate and share their opinions about diverse matters like environmental protection, global warming, climatic change and abuse of human rights. Therefore, mobile social networks were harnessed by educators and students not only as platforms for disseminating critical citizenship and community engagement messages but rather as conduits for individual and collective expression of global issues. This finding contradicts existing literature. For instance, while Mossberger & Wu's (2012) acknowledge the potential of social networks to foster civic engagement and local e-governance because of the multiple opportunities they create for public dialogue on governance matters, there was no evidence to suggest that American city councils are using these websites to promote public discussions about their work.

Facebook mobile was also employed diplomatically for mobilising peers engagement in public decision making. Students harnessed it to enlist their peers' support and involvement in the signing of petitions on limited government action on climatic change and to voice their concerns about mob justice. As Boulianne (2009) suggests, the increased information access via Internet sites may reduce knowledge deficiencies that are used to excuse disengagement. More so, new online opportunities for self-expression potentially leverage the identification and organisation of like-minded citizens, and expand their engagement with diverse populations.

Implications for pedagogical change
The educators employed multiple learner-based teaching strategies such as provision of relaxed delegated authority to tutors (who were also postgraduate students) to engage and summarise online discussions, to promote peer-based deliberations without their direct involvement, post visual representations (pictures, videos and animations) and post notifications about critical awareness developments (petitions and campaigns). They also provided background information on complex citizenship and community engagement issues that cognitively scaffolded students.

Collectively, these strategies impacted pedagogy in several ways.

- Fostered constructivist teaching methodologies-The provision of background materials (multimedia representations) that fed into Facebook mobile discussions on community engagement potentially enabled the collaborative construction of pedagogical content knowledge. The emergent forms of talk back processes and coupled with the transformed roles of educators (from "sages on the stage" to information brokers, guides on the side and neutral participant observers) also served to present a collaborative, discursive pedagogy that potentially transferred the responsibility for critical dialogue, self-reflection and self-regulation in decision making about knowledge from educators to students.

- The formative conversational exchanges among them potentially enabled educators to make inferences about their processes of meaning making as well as discern the valid judgments that they made about what qualified as objective knowledge in community engagement and citizenship discourses. These informal inferences by educators potentially broadened the educators' opportunities to reflexively engage with their teaching practices, identify teaching gaps that they needed to fill in through providing more focused seminars including addressing student misconceptions and challenging areas of student learning. This could have triggered a shift from the traditional "blanket approach" towards a pragmatic, strategic approaches that targeted "problem areas" and "soft spots" among students.

- The use of social presence rather than direct involvement in Facebook mobile enhanced student acceptance of academic mentors that contributed to the breaking of social distance between them. Social presence and the continual reinforcement of teaching (through provision of background information) potentially contributed to increase on-task behaviour from students, heightened interest in the course, and educator familiarity with the students.

Conclusion

The study explored educators' use of mobile social networking to teach community engagement and critical citizenship at a South African university. Theory of Community of Practice was employed to demonstrate how students shared domain knowledge and practices on critical citizenship and community engagement. From an educators' perspective the use of four student centred teaching strategies enhanced their exchange of shared repertoires, domain knowledge and social practices of the discipline. An analytical framework on community engagement was integrated with CoP concepts to provide a unified analytical framework for examining the different forms of student engagement that emerged from their multiple interactions with academics, peers and content. Students deliberated on ten themes that ranged from supranational interventions, political activism issues to national disasters. While different pedagogical interventions were explored that ranged from direct instruction to integrated approaches of teaching, the drawbacks of teaching with mobile social networks included the fragmented nature of discussions, suboptimal quality of the discussions and the incommensurate attention paid to the exploration of certain concepts.

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USING MOBILE TECHNOLOGY TO ENHANCE LEARNING IN RURAL SCHOOL

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Abstract
This paper discusses how schools that were provided with tablets in the Kgetleng River Area Office, a rural area in the Ngaka Modiri Molema district of the North West province benefit from the tablets. Qualitative and quantitative methods of collecting data were utilised. As a way of improving the education, the department of education with a host of sponsors has helped many rural schools to obtain tablets with an aim to enhance the education of learners. The question posed in this study is, Are tablets in rural schools well utilised to the benefit of learners? The mixed method was used. Participants were 120 their ages ranged between 14 and 55 years. The study revealed that tablets that were given to schools by either the Department of Basic Education or sponsors are not fully utilised. It is recommended that Department of Basic Education make follow up on technologies provided to schools, so that they know if what they provided to schools is useful or not.

Keywords: Tablets, mobile technology, teachers, learners and rural schools

Introduction
Technology can be very useful to teaching and learning as a whole. For example, social networks such as Facebook and Twitter can be used to open a class account for homework purposes. This would have to be tightly regulated and monitored. Since 1994 the South African education landscape has undergone major transformation in governance, management, curricular reform, and teacher professional development (Department of Education, 2004). To achieve these objectives, some schools in the Kgetleng River Area Office (AO) have been supplied with tablets. Many schools are asking for computer sponsorships instead of books, encyclopaedia, dictionaries and or other physical resources that would improve basic skills without high costs. The Department of Basic Education (DBE) was responsible in most instances for providing schools with computers and lately tablets. The main aim of supplying these tablet computers to schools was to allow learners to be abreast with modern technology. Twenty-first century technologies are rapidly spreading into rural Africa, Asia and Latin America (Barr, 1999). This study aims to look into whether the tablets in schools in rural areas of the North West province are utilised and benefit learners. Since, South African schools have used traditional teaching methods that have stayed the same for the last few decades or so.

Through the internet, learners are directly and indirectly exposed to all sorts of information. Some of this information is good and educational but there is also information that is unsavoury, harmful or even dangerous. An educator has to be the one to use forceful measures to protect learners from accessing potentially harmful information.

The challenge faced by schools in South Africa that do not use ICT as a means of enhancing teaching and learning has led to South Africa's failing to close the 'digital divide'. The digital divide is defined as the gap between those individuals who benefit from digital technology

and those who do not (Best & McLay, 2002). The use of ICT in schools to enhance learning could help overcome some of the challenges of improving the efficiency and productivity of both learning and teaching, thereby narrowing the digital divide (Chitamu, van Olst & Vannucci, 2003). The challenge for educators is to stay aware of the type of information available, the technology used to access it and how it might affect learners. Learners need to develop ICT skills so that they can function effectively in the broader society and can contribute to the sustained use of ICTs within it.

A tablet is a wireless, portable personal computer with a touch screen interface. The tablet form factor is typically smaller than a notebook computer but larger than a smartphone. Tablets do retain an edge, however, in the moments just after the initial setup. For a person with who is computer literate opening a Web browser on any modern computing device is a nothing, but what about finding the calculator, changing settings, or customizing the wallpaper? These are not easy things for educators in rural areas. Windows, OS X, and Linux still have a learning curve that tablets lack, and this makes them less pleasant and less approachable. These minor frustrations add up over time and can eventually lead to a sour impression that doesn't fade.The term information and communication technology (ICT) includes the technologies which together support people's ability to manage and communicate information electronically, it is a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include tablets, computers, the Internet, broadcasting technologies (radio and television), and telephony. ICT includes not only computers, but also equipment or hardware such as printers and scanners as well as the software and systems needed for communication, such as the Internet. Video recorders, television, radio and digital cameras are also included, but these technologies are less frequently used in most school contexts (Fallows & Bhanot, 2002). One reason for the focus on computers and the Internet is the role that ICT plays in enhancing learning, especially in the context of recording, processing, storing and sharing information with others. Many studies of the impact of technology on teaching and learning conclude that technology has an important role to play in education at all levels, from Grade 0 to Grade 12, although it will not solve all educational problems (Kritzinger & Padayachee, 2010). A number of research undertakings have shown that information and communication technologies (ICT) make a significant contribution to economic growth and social development of communities. According to the 2011 General Household Survey (GHS) of Statistics South Africa, in South Africa, ICT is accessed through functional landline telephones, cellular phones and internet connections (E-learning Africa Report, 2012). This information provided a sense of household-level access to the basic ICT devices across rural South Africa. In line with the national policy the Strategy Framework is based on two strategic pillars: The development of eLearning in schools through effective use of ICT for education. The development of eAdministration through the use of ICT was aimed to improve management, administration and professional practice between head office, districts and schools

ICT in education
This is the age of technology and one finds that large amounts of information are available at the click of a button. This enables educators and learners to improve their knowledge easily. In 1999, the South African government established the State Information Technology Agency (SITA), which serves as a public sector ICT company focused on the effective and efficient provision of ICT services with government at national, provincial, and local levels. Its range

of services includes the setting of technology standards for the use of refurbished PCs in public education institutions. ICTs is an umbrella term that includes any communication device or application, encompassing: tablets, radio, television, cellular phones, computers and network hardware and software, satellite systems, as well as the various services and applications associated with them, such as videoconferencing and distance learning (Barr, 1999). The South African government saw the importance of ICT and as a result it recognised the important role that ICT can play in the development of the economy, society in general and in education and training. The Presidential International Advisory Council on Information Society and Development therefore identified three focus areas for developing ICTs, namely education, health and small and medium enterprises. Consequently, following a draft and consultation, the Department of Education had finalised a White Paper on eEducation which sets out a policy framework for the implementation of a strategy to expand the use of ICTs to increase the effectiveness of development interventions, improve the quality of teaching and learning and to produce a pool of ICT engineers, programmers and software developers in order to compete in the global economy. eEducation is about connecting learners and teachers to each other and to professional support services for schools, providing more effective platforms for learning (Department of education. 2006).

The government's eEducation Policy provides the framework for the use of ICT in education to improve communication and administration in provinces, districts and schools, to facilitate the professional development of teachers, managers and administrators, to provide training in ICT and to integrate the use of ICT in the curriculum, by providing information and resources for teaching and learning and by providing on-line or software based learning opportunities. The white paper on eEducation of August 2004 has the overall policy goal that: *'Every South African learner in the general and further education and training bands will be ICT capable (that is, use ICTs confidently and creatively to help develop the skills and knowledge they need to achieve personal goals and to be full participants in the global community) by 2013'.*it is important to note that a firm understanding of ICT is essential in the modern world (Department of Education (DoE), 2003). However, it is impossible for teachers to develop such knowledge in learners if they themselves have no real grasp of ICT (Castells, 2001). The draft white Paper on eEducation also identifies policy imperatives that are set out under six strategic objectives (Department of Education (DoE), 2003): 1. ICT professional development: every teacher, manager and administrator in general and further education and training must have the skills, training and support they need to integrate ICT in teaching and learning. 2.Electronic content resources: The school curriculum in general and further education and training is supported through effective and engaging software, electronic content and online learning resources and teachers, content developers and administrators contribute effectively to these resources. 3. ICT Infrastructure: Every teacher and learner in general and further education and training must have access to an ICT basic set, including computers 4. Connectivity: Every teacher and learner in general and further education and training must have access to an Educational Network and the Internet. 5. Community engagement: Schools must work in partnership with families and the wider community to ensure shared knowledge about ICTs and extended opportunities for learning and development through ICTs. 6. Research and development: The research and development community must continuously assess current practices and explore and experiment with new technologies, methodologies and techniques that are reliable and will support teachers and administrators in eLearning and eAdministration.

There is a lot of evidence existing that indicates that technology can make a huge difference in education. Teachers report significant improvements in learning outcomes (DPSA. 2001). The benefits of the use or introduction of ICT in schools are immense; it is thus important that all stakeholders concerned with the South African education fraternity, such as government, the private sector, teachers, learners, school principals and society in general, join together and make effective efforts to ensure that ICT is introduced or used in South African schools in order to achieve educational development and enhance the productivity of teaching and learning (Bialobrzeska & Cohen, 2005)

South African context and basis of the study
The South African education system has for a number of years faced immense challenges, which range from educator union strikes to low pass rates at matric level, high dropout rates, high levels of absenteeism by teachers in schools and, mainly, the poor efficiency and productivity of both teaching and learning in schools. One way in which the country could overcome the challenge of low efficiency and productivity of both teaching and learning would be through the use or introduction of ICT in South African schools. Since 1994 the South African education landscape has undergone major transformation in governance, management, curricular reform, and teacher professional development. Central to this transformation has been a complete policy overhaul in the form of a new national qualifications framework (NQF) and a new curriculum framework for schools based on the concept of outcomes-based education (OBE) (Department of Education, 1995). South African schools have used traditional teaching methods that have stayed the same for the last few decades or so. Educational institutions in South Africa, in particular previously disadvantaged schools, face numerous challenges, such as the dwindling ability to collect school fees from parents of learners, and declining financial support from the government. Narrowing the digital divide means ICT resources must be provided to those who do not have them, and that their competencies to access and process the knowledge that these resources make possible must be developed (Chitamu, van Olst and Vannucci, 2003). Understanding this will enable educators to speak with authority and knowledge, instead of assumptions. It is generally recognised that programmes to develop ICT capability in a country should give priority to ICT in education. Providing South African schools with ICT resources is a challenging task. The White Paper on e-Education (Department of Education 2004) acknowledges the magnitude of the task of delivering ICT and the infrastructure required for ICT in schools. It proposes that the integration of ICT into schools should take place over three phases. When the final phase is complete, in 2013: all education departments in the country will use ICT for planning management, communication and monitoring and evaluation; all schools will have access to a networked computer facility for teaching and learning, and to high quality educational resources; all schools, teachers and learners will be confident and competent users of ICT, and ICTs will be integrated into teaching and learning at all schools; and communities are involved in ICT developments at all schools. This has not been achieved but the department of basic education is still on course trying to meet this expectation. In addition to the challenge of obtaining ICT and the infrastructure to support it, schools face the equally important challenge of how to make the best use of these resources in their particular contexts. Good educators know that the core function of education is enlightenment whereby learners has to be taught how to make good judgements

South Africa's poor rural areas are inhabited by people who have a variety of literacy skills ranging from trained teachers who cannot find employment within the education system to semi-literate and illiterate individuals. Technology brings about choices that are coupled with responsibilities, the most important being to make sound judgements. It is the responsibility of both parents and educators to play a part in educating the child on how to make choices. An educator as a way of aiding the learners can dedicate a lesson to discussing the pros and cons of social networks and the effective use of internet. Educators and parents need guide and encourage learners to make responsible choices so that they can embrace the positive aspects of technology (Molepo, Khumalo & Mji, 2015). New ICT technologies need to exploit the various skills of these community members to generate revenue for themselves by offering remote ICT services beyond their neighbourhoods. ICT solutions that support multimedia communications enhance the ability to exploit various skills of community members including those that do not have written skills. Security sensitive areas require video surveillance solutions to monitor and detect any suspicious behaviour. People who do not necessarily have written skills can monitor surveillance cameras remotely through appropriate ICT solutions (Tryhorn, 2009). Individuals with better literacy skills can be trained to offer services such as ICT problem solving etc. The use of computers was introduced into schools in South Africa during the 1980s, primarily in private schools and a few well-resourced government schools. Initially computers were used mainly for administrative purposes, such as keeping student records, recording examination marks, producing school reports and creating timetables, but with the continuous advances in ICT, this later changed. Despite the desperate need for ICT implementation in schools to be spread across the length and breadth of South Africa, there are a number of challenges that make it impossible to achieve this goal. One needs to highlight the importance of the usage of ICT in schools. The e-learning Africa Report 2012 is a survey completed by 447 respondents reviewing the eLearning experience in Africa over the last five years and is the first of its kind, bringing together the views of eLearning professionals and a range of other stakeholders from across 41 African countries. The researchers found the following with regard to the benefits or impact of the use of ICT in teaching and learning: ICT motivated learners to learn, it made distance learning easier, it made learning more fun, it encouraged learners to learn more independently, provided that learners were guided appropriately by teachers. It encouraged learners to produce knowledge themselves (Siluma-Mmekoa, & Welch, 2004). Learners pointed out that more content was available to them via the internet. Through ICT learners were connected to experts and had access to global resources. Learners had access to quality learning material. The research also shows that learners showed a better understanding of topics under study (Mdlongwa, 2012). It is important to teach learners to use technology as a tool for learning. It has been found that many schools with financial resources use technological gadgets in class. Even if this innovative approach is good, these tools should not be seen to distract from the skills of reading from a book, writing using a pen and other methods of education and communication that were used in the past.

Method

Participants

The targeted population comprised of teachers, principals and learners from one region of the North West province. The region has 128 schools including primary and high schools. Random sampling was utilised. The sample was made up of 120 participants, comprising 10 principals as well as 40 educators and 70 learners. Participation by all individuals was

voluntary because the purpose of the study was clearly explained to all possible participants. All questions and queries were addressed to their satisfaction. Examples of questions asked included (a) "... will you put my name in your report?" (b) "... will you report what I say to the department of education?"

Instrument and procedure
In this study both qualitative and quantitative methods of collecting data were utilized. In essence this was a mixed methods study. It is averred that the goal "…of mixed methods research is not to replace either of these approaches but rather to draw from the strengths and minimize the weaknesses of both in single research studies ... " (Johnson, & Onwuegbuzie, 2004, p. 14 - 15). In a similar vein, it has been pointed out that when the two methods are used in combination, the weakness of one could be balanced by the strength of the other (Breakwell & Millard, 1995). The aim of utilising both qualitative and quantitative methods here was to use these as some form of triangulating findings. This means that one method was used in some aspects of the study to verify and corroborate participants' assertions and views in the other method. A questionnaire comprising two sections was used to collect data. The first section requested the participants to provide biographical data in terms of age, gender, highest academic qualification and work experience.

Results and discussion

Biographical data
Participants were 40 educators, 10 principals and 70 learners. Table 1 shows the biographical data that the participants were requested to provide. It may be observed from the table that the majority of participants were women. Participants' ages ranged between 14 years and 55 years. It can also be seen that majority of participants 59% are having grade 12 or lesser qualification. This is due to the fact that this study included learners.

Table 1 Biographical information of the participants (N = 120)

Category	N	%
Gender		
Women	75	62.5
Men	45	37.5
Age		
14 – 20	71	59
21 – 39	31	26
40 +	18	15
Highest academic qualification		
Grade 12 and below	71	59
Diploma (e.g. Diploma in primary education)	19	16
Degree or higher(e.g. B.A. or B.A. Honours)	30	25
Position held in school		
Educator	40	33
Principal	10	09
Learners	70	58

Deliberations on the use of the tablets in schools

Participants were requested to indicate whether their schools were utilising the tablets that were sent to them (schools) for education purposes. Table 2 shows the responses of respondents on what is the situation in schools about the use of tablets in their schools. Respondents were asked to respond to the "Yes" and "No" questions on the use of tablets.

Table 2 Frequency distribution and percentages in terms of deliberations on the use of tablets in schools.

Tablets in schools	Yes/No N (%)	Educator	Principal	Learners
1. Has you school been provided with tablets?	Yes	40 (100)	10 (100)	70 (100)
	No	0 (0.0)	0 (0.0)	0 (0.0)
2. Are all tablets working?	Yes	40 (100)	10 (100)	66 (94)
	No	0 (0.0)	0 (0.0)	4 (6)
3. Does your school have qualified computer teachers?	Yes	4 (10)	2 (20)	6 (9)
	No	36 (90)	8 (80)	64 (91)
4. Are your schools connected to internet?	Yes	40 (100)	10 (100)	9 (13)
	No	0 (0.0)	0 (0.0)	61 (87)
5. Are all educators in your school computer literate?	Yes	7 (17)	2 (20)	1 (23.1)
	No	33 (83)	8 (80)	69 (76.9)
6. Does your school have the latest computer software?	Yes	20 (50)	3 (30)	5 (7)
	No	20 (50)	7 (70)	65 (93)
7. In the case that the school has no qualified computer teacher, is your school prepared to train them all?	Yes	40 (100)	10 (100)	35 (50)
	No	0 (0.0)	0 (0.0)	35 (50)
8. Do you have constant supply of electricity?	Yes	12 (30)	3 (30)	10 (14)
	No	28 (70)	7 (70)	60(86)
9. Are your tablets in a well secured place?	Yes	40 (100)	10 (100)	70 (100)
	No	0 (0.0)	0 (0.0)	0 (0.0)
10. Is your school helping the community to acquire computer skills?	Yes	0 (0.0)	0 (0.0)	0 (0.0)
	No	40 (100)	10 (100)	70 (100)

From the responses here, one can deduce that all school in this study has tablets. One can also conclude that most of the tablets are in a working order. Based on what respondents have stated, one can notice that in most schools there are no qualified computer educators. This in itself shows that the acquisition of basic computer skills is a challenge since the expectation is that teachers have to transfer their computer skills to learners. Most people agree that internet connectivity is very vital for using ICT for education (Benjamin, P. 2000). This is

said since through the use of internet, people will be able to research on a variety of topics. From the respondents, there are very few schools that have access to internet which means that the school community will not be in a position to access important data from the internet.

The results presented here have shown that the participants were relatively young people, 59% were 20 years and less. The reason for this was that researchers included learners since tablets are sent to schools to benefit them (learners). The results also showed that most schools did not have educators with computer skills. After responses from the questionnaires, interviews were also utilised to get all the reasons for the usage or non-usage of the tablets in schools. Responding to the question "why are your school tablets not used?" responses to this question were different. Respondent 4 indicated that "…*we do not have people with skills to operate this computers…people with knowledge are from far and are not able to come here every time*". This was supported by Respondent 54 who indicated that "…*it seems like our educators are not willing to utilise them…they always come with excuses that they are lagging behind with the syllabus and tablets will waste more time*". Another respondent came with a different reason for the non-utilisation of the tablets. Respondent 9 indicated that the problem of the tablets was mostly time oriented. She stated that "…*tablets are in the principals` office in the strong room…when the bell ring, the educator has to leave the staffroom, go to the principal's office to collect the tablets distribute them amongst the learners, then tell them to follow her step by step*". Different respondents came up with different reasons for the non-use of their tablets. The one reason that came up in most instances was the lack of skills on the side of educators. Most respondents maintained that there was a serious need for skills transfer in that teachers needed to be trained on the use of computers and their knowledge be transferred to learners and the community at large. We therefore recommend that teachers in schools should be trained in computers. The department can outsource universities to train teachers on ICT. Workshops of a week or two can be organised for teachers to learn computers since without them, skills can't be transferred.

Limitations and conclusion
While the sample of this study was randomly selected the results presented here are in no way meant to be generalised to all schools in the North West province. It is worth pointing out that the putting into practice of ICT in rural schools has a lot of challenges on its own hence this paper may not be seen as comprehensive in any way. Because of this, the researchers' aim to know if tablet given to schools by the department of basic education and some donors are utilised or not and the reasons for either response was achieved. This research has made it clear that tablet computers are not used. It is recommended that the Department of basic education should make follow-ups in all the schools that received tablets and encourage educators to utilise the. Workshops on how to use them must be done constantly so that educators can have necessary skills and confidence in using them.

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AN INVESTIGATION OF INFORMATION AND COMMUNICATIONS TECHNOLOGY LITERACY OF PRIMARY SCHOOL TEACHERS IN THE BOBIRWA CLUSTER IN BOTSWANA

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Abstract:
Information and Communications Technology (ICT) is considered nowadays as a potential tool that provides educational opportunities in both formal and non-formal ways. The development of information technology has had a great impact on education and has dramatically changed the instructional methods, curricula, scope of learning, and role of the teachers and students in the instructional setting. However, the greatest challenge in for promoting educational effectiveness in the 21st century is the ability of teachers in schools to acquire informational literacy competencies and to apply technology in their daily activities in their institutions. In a bid to improve the quality and quantity of students' learning and outcomes, governments have become increasingly willing to make major investments of fiscal and human resources into hardware, software, and training. The Government of Botswana has also made a large investment in the improvement of the information environment in both primary and secondary schools and has administered various training programs and seminars for improving information and communication technology proficiency. The main purpose of this study is to establish Information and Communication Technology (ICT) literacy of primary school teachers in the Bobirwa cluster in Botswana public schools. A mixed methods approach will be utilized. The researchers adapted the Framework of ICT Literacy for Primary School Teachers which was developed in 2003/2004 informed the study; and from its elements a questionnaire was developed. An interview schedule was also utilized. The main finding of this study is that the majority of primary school teachers are ICT illiterate.

Keywords: Botswana, Information and Communication Technology, primary school teachers, ICT literacy

Introduction

It is apparent that information and communication technology (ICT) has become, within a very short time, one of the basic building blocks of modern society as it is applied in almost all sectors. Juma, Raihan and Clement (2016) support this by declaring: "Information and Communication Technologies (ICT) application in education has gained popularity over the past 20 years and this has led to changes in the way educational institutions carry out activities and processes not only in teaching and learning process or monitoring of students' progress but it has also had an impact in educational administrative processes and management of higher educational institutions" (p. 1). Globally, ICT permeates the business environment, it underpins the success of modern corporations, and it provides governments with an efficient infrastructure. It also adds value to the processes of learning, and in the organization and management of learning institutions. The Internet is a driving force for much development and innovation in both developed and developing countries. This trend is

also clear as many countries globally regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing and numeracy.

Information and communication technology, or ICT, is defined as "the combination of informatics technology (technological applications (artifacts) of informatics in society) with other, related technologies, specifically communication technology" (UNESCO, 2002, p.13). Juma, Raihan and Clement (2016) support this by declaring: "Information and Communication Technology (ICT) as technology that supports activities involving the creation, storage, manipulation and communication of information, the application and use of ICT has led to the emergence of different forms of microelectronic and telecommunications tools such as laptops and computers, computer networks, the Internet digital printers and mobile technology, which enable administrators to record, store, process, retrieve, and transmit information" (p.1).

Information literacy is defined as a person's information ability including the skills of managing information and the knowledge of applying information (Bruce, 2000; Doyle, 1994). Computer and information literacy refers to an individual's ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in society (Fraillon, Schulz & Ainley, 2013). The international panel defines ICT literacy as the ability to use digital technology, communications tools and networks to access, manage, integrate, evaluate and create information in order to function in a knowledge-driven society (Kenney, 2006). Khalkhali, Moradi and Amuei (2008) have described ICT literacy as having the following components: "using digital technology, communicative tools and access to communicative and informative networks, information management, data incorporation and integration, data evaluation and creation for accessing cognitive function in society" (p.397).

Pernia (2008) described ICTs as technologies used to communicate in order to create, manage and distribute information. She adds that a broad definition of ICTs includes computers, the Internet, telephone, television, radio and audio-visual equipment. She further explains that ICT is any device and application used to access, manage, integrate, evaluate, create and communicate information and knowledge. According to Chemwa and Mburu (2007), ICT hardware includes electricity infrastructure, desktop computer, laptop computer, CD drive, printer, scanner, telephone (mobile or landline) and projector. Onunga and Shah (2005) describe software as detailed instructions called programmes and data that enable the hardware to perform its tasks at high speed. They further classify computer software as system and application software. They outline that system software, which manages computer operations, includes the operating system of the computer, a compiler that translates programs and utility programs such as back up. In addition, the authors mention that application software handles the needs of the end user to solve specific problems; examples include software packages that can be used in school administration and related tasks.

Khalkhali, Moradi and Amuei (2008) have argued that much as ICT is indispensable and has been accepted as part of the contemporary world especially in the industrialized societies, the field of education has not been unaffected by the penetrating influence of information and communication technology. Making reference to Iran's schools, Yusuf, (2005) points out that

it provides opportunities for teachers and students to communicate with one another more effectively during formal and informal teaching and learning. For teachers to be more effective in their job of infusing ICT in education, researchers have come to realize that their ICT literacy neeeds to be enhanced and this can be done through training such as professional development. Khalkhali, Moradi and Amuei (2008) highlight this by positing that "teacher training is crucial using ICT, because ICT are tools that on the one hand can facilitate teachers training and on the other hand help them to take full advantage of the potential of technology to enhance student learning" (p. 396). One result from research has persistently shown that teachers were very weak in computer literacy and skills.

What is apparent is that information and communication technologies (ICT) were accepted and infused into schools without fundamentally changing the way we learn and teach (White, 2005). ICT was merely adapted to traditional school structures, classroom organization and existing teaching practices (Anderson & Becker, 2001), in most cases without addressing comprehensive educational reform (Earle, 2002). This approach was a result of a lack of understanding that ICT was a tool which needed to be utilized by people to meet their expectations. It was then realized that one of the most significant barriers to successful integration of ICT and transformation of learning have been teachers' lack of confidence, experience, and pedagogical understanding in mobilizing the potential of digital technologies (Dale, Robertson, & Shortis, 2004). Dakich (2005) is of the opinion that "due to global implications related to this problem, empowering teachers with pertinent ICT skills and knowledge has become an important issue engaging various stakeholders such as policy makers, researchers, and practitioners in the field of learning and teaching with ICT" (p.2). This is so because people have come to understand that alone, ICT cannot revolutionize and change the education sector.

Theoretical Framework
Several studies have been carried out which resulted in the creation of international, national, and state level frameworks with the aim of identifying ICT skills and competencies for teachers (Becta, 2003; & Dakich, 2005). Dakich (2005, p. 2) posits that: "The focus has slowly shifted from a technocratic definition of functional computer skills towards a more contemporary view of multiliteracies, embracing not only the operational but the cultural, critical and human aspects of using ICT".

This study is informed by The Framework of ICT Literacy for Primary School Teachers was developed in 2003/2004, by an international panel of ten experts, utilizing the Delphi method (Dakich, 2004). The framework of ICT literacy generated by the Delphi panel which includes four dimensions of teachers' ICT literacy: Operational Understanding and Application of ICT, ICT-Rich Pedagogies and Learning Environments, ICT for Professional Learning and Engagement, and The Social Ecology of Living and Learning with ICT, as presented in Figure 1 below:
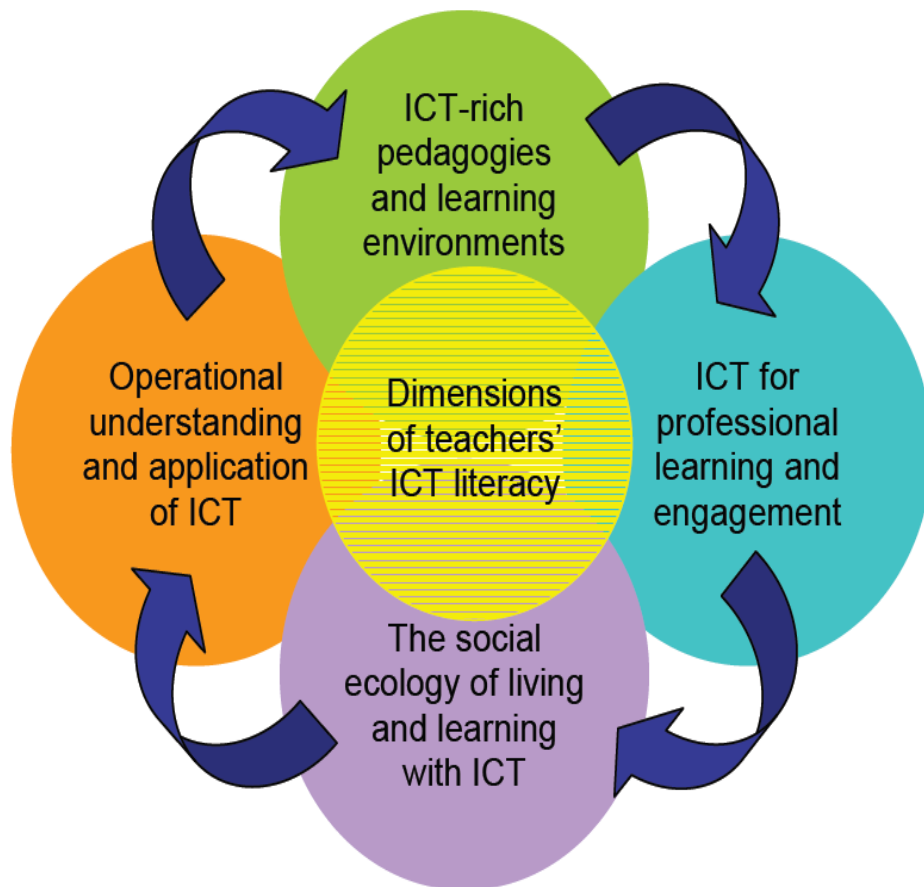
Figure 1: The four dimensions of teachers' ICT Literacy (Source: Dakish, 2005, p.4)

The first dimension looks at the operational understanding and application of ICT which include: "having up-to date understanding of ICT used in school, workplace, home and community; demonstrating professional judgment and skill in the selection and application of common computer software and hardware, as well as demonstrating familiarity and utilization of network resources for communication and research purposes" (Dakich, 2005, p. 3).

The second dimension describes teaching practices, and ICT-rich pedagogies that are embedded in the pedagogical rationale of constructivist learning environments (Sharp, 2002), and connected communities of learners (Siemens, 2004). The role of the teacher is to design, facilitate and scaffold student enquiry, by making informed choices about the relevance and responsiveness of ICTrich learning experiences to the diverse needs of learners, and the context of living and learning in the contemporary world.

The third dimension lays emphasis on developing critical consciousness about how ICT can be integrated into everyday professional practices, to assist and facilitate professional inquiry, continuous learning, collaboration and connectedness with the local and global community. It also focuses on the critical understanding of how the integration of ICT can influence the restructuring and reorganization of classrooms and schools for improved student learning.

The third dimension further describes ICT-rich practices and approaches related to professional learning and engagement. It also emphasises the development of critical consciousness about how ICT can be integrated into everyday professional practices to assist and facilitate professional inquiry, continuous learning, collaboration and connectedness with the local and global community. It also focuses on the critical understanding of how the integration of ICT can influence the restructuring and reorganization of classrooms and schools for improved student learning.

The fourth addresses the social ecology of integrating ICT into everyday practices. It has a strong focus on developing and implementing conscious strategies that address equity, inclusion, and ethical conduct (embracing moral and legal aspects), as well as health and safety related issues when integrating ICT into learning and teaching. It also promotes the need for teachers to be familiar with recreational uses of ICT and its role in youth culture.

The Study Context
The Government of Botswana has joined the global bandwagon by accepting the advant of technology into all the sectors of its economy. In order to create a condusive environment the Government took a lead by developing a National Technology Policy called Maitlamo to give guidance to its citizens in the area of technological advancement. According to Mochothi (2014, p. 3), "Maitlamo is an ICT policy that provides Botswana a with clear and compelling roadmap to drive social, economic, cultural and political transformation through the effective use of information and communication technology".

Some of the aims of the policy that are relevant o education are:
- All teachers to receive ICT training by December 31, 2010
- ICTcontent and curriculum development available at all levels of the Education system by December 31, 2010
- A recommendation that a 1:7 computer to student ratio be introduced into all schools by December 31, 2012 has been proposed however the exact ratio still to be determined.

In order to meet some of the aims of the Maitlamo Policy, most schools have computers installed for use by staff and students. The colleges of Education have a course called Communications and Study Skills (C.S.S) which is aimed at training teachers to be computer literate. The University of Botswana too has General Education courses namely GEC121 and GEC122 which provide teachers with computer skills. There is also a course of the University of Botswana called EDT 310 that further promotes computer literacy among student teachers (Mochotlhi, 2014).

Statement of the Problem
The Government of Botswana has over the years made large investments in the improvement of the information environment in both primary and secondary schools. This was done through various training programs and seminars for improving information and communication technology proficiency. The Government of Botswana also produced a National Policy named Maitlamo to give guidance. The main purpose of this study is to establish Information and Communication Technology (ICT) literacy of primary school teachers in the Bobirwa cluster in Botswana public schools.

Research Questions
The following research questions guided the study.

1. To what extent are primary school teachers literate in ICT?
2. To what extent are the necessary infrastructures for ICT available in Primary Schools?
3. To what extent are primary school teachers knowledgeable of the educational applications of ICT?
4. What challenges do primary school teachers face when integrating ICTs in teaching and learning?
5. What are the benefits of integrating ICTs into educational proceses?

Methodology
This study used what is variously called multi-methods (Brannen, 1992), multi-strategy (Bryman, 2004), mixed methods (Creswell, 2003; Tashakkori &Teddlie, 2003), or mixed methodology (Tashakkori &Teddlie, 1998) research. Cresswell & Clack (2011) defined it as an approach in which both quantitative and qualitative approaches are used as they provide strengths that balance the weaknesses of both. It has further been argued that the mixed methods approach offers a collection of flexible research designs that seem well suited to support rigorous examinations of promising ideas. Creswell (2003) described six somewhat overlapping mixed methods research designs, referred to as strategies of inquiry, that guide the construction of specific features of a mixed methods study. The six designs by Creswell (2003) draw on the strengths of qualitative and quantitative methods to enhance inquiry in ways unlikely to occur with singular applications of these methods. Cresswell and Cack (2011) posited that mixed methods research provides more evidence for studying a research problem than either qualitative or quantitative research alone. The researcher also decided to use a mixed approach because it provided an opportunity for gathering detailed information as it used multiple tools for data collection.

Population and Sampling
The population for this study is all primary school teachers in the Bobirwa cluster in Botswana public schools. They were targeted because the Government of Botswana through its policy on ICT has emphasized that all government institutions should integrate ICT in all their processes; and this included schools. All teacher education institutions including the University of Botswana are offering ICT related courses for all potential teachers.

The sampling procedures used were random sampling and purposive sampling. Random sampling was used so as to allow all the teachers to have an opportunity to participate while purposive sampling will be used for interviews with some of the people who would have shown that they have a lot of information on the subject under study.

Data Collection
For data collection, a questionnaire with both closed and open ended questions and a semi-structured interview schedule were utilized. The benefits of using these approaches include richness of data and deeper insight into the phenomena under study. They also include complementarity and triangulation of data and methods. In this study a semi structured interview schedule was utilized to enable the phenomena under investigation to be explored in breadth and depth. The semi structured interviews worked well as the interviewer had

already identified a number of aspects he wanted to address. An open ended questionnaire was used to gather data from many people.

Ethics

As the study dealt with human beings, permission was sought from the Ministry of Education and Skills Development's Ethics Committee. The instruments were pilot tested among a group of teachers in the Bobirwa Cluster. Feedback from the piloting exercise was used to fine tune the instruments. The respondents were also informed that participation in the study was voluntary and they could terminate their participation at any time without any consequences.

Data Analysis

For the closed ended questions, a computer software called SPSS was used to analyse data. Content analysis approach was used. It involves coding and classifying data. Content analysis is a procedure for the categorisation of verbal or behavioural data, for purposes of classification, summarisation and tabulation. The content was analysed on two levels. The basic level of analysis was a descriptive account of the data: this is what was actually said with nothing read into it and nothing assumed about it. The other level of analysis was interpretative and it was concerned with what was meant by the response, what was inferred or implied.

The trustworthiness and validity of the findings were established bytraingulation through the use of multiple data collection devices and sources.

Findings and Discussions

This study set out to investigate the ICT literacy of teachers in primary schools. The study aimed at establishing the extent to which primary school teachers in the Bobirwa Cluster were ICT literate. The findings are presented and discussed according to the research questions.

Biographic Data

This section presents in detail the biographic information of the respondents in the study so as to inform the reader of the characteristics of those who participated.

Table 1: Personal Data

Characteristics of Participants	Number of Participants (124)
Gender:	
Male	46
Female	78
Age:	
20 – 25	4
26 – 30	20
31 – 40	48
Above 40	52
Highest Qualification:	
Primary Teachers' Certificate (PTC)	2
Diploma in Primary Education (DPE)	102
Bachelor of Education (B. Ed)	20

Training in ICT:	
Formal Training	34
Informal Training	18
No Training	72

Table 1 above shows that there were 46 (37.1%) males and 78 (62.9%) females who participated in this study. The findings also show that the teaching force in the area was aging and there was a need to start preparing for a succession plan as the majority of the respondents were above forty years or 52(41.9%). This is followed by those between 31 and 40 years who constitute 38.7%.

ICT Training

For any country in the world to effectively compete, there is a need for highly educated and skilled workers in information and communication technology. This can be achieved if teachers at all levels of the education system are ICT literate so that they can help the students with the basic ICT skills and knowledge. For teachers in school to be efficient and effective in the use of ICT, they "need visions of the technologies' potential, opportunities to apply them, training and just-in-time support, and time to experiment" (Jung, 2005, p.94). There is a danger that teacher training emphasizes the technical skills of the teachers, where the aim is to learn to use certain software like spreadsheets or word processors. Teacher education should focus on the design of electronic educational materials that are compatible with the compulsory school curriculum subjects. Furthermore, it is suggested that in-service training courses should shift from the development of technical skills to the didactical aspects of integrating ICT into education. Therefore attention should be paid to the development of thinking and new skills required in the information age such.

The main objective of such training should be to equip teachers with the needed technology skills and knowledge that will be handy in integrating ICT in their teaching. It has been argued that much as ICT cannot be regarded as a solution for all educational problems, technologies should be seen as essential tools for teaching and learning (Jung, 2005). The use of ICTs in classrooms usually requires teachers to have a high degree of technical skill and the capacity to integrate computer use into their teaching.

Table 2: Training Status

Age	Highest Qualification	Formal	Informal	No Training
20 - 25	DPE	0	0	4
26 - 30	DPE	6	4	8
	B. Ed	2	0	0
31 - 40	DPE	10	8	24
	B. Ed	6	0	0
Above 40	DPE	6	34	0
	B. Ed	10	0	2

The above Table shows that 72(58.1%) of the respondents had no training in ICT at all, 18(14.5%) had some informal training while 34(27.4%) had some formal training. Of those with formal ICT training, 90% of those with a B.Ed qualification have formal ICT training. The B.Ed (Primary Education) programme offered at the University of Botswana has a compulsory course 121 which is done by all students. This course makes teachers in our

schools to be efficient and efective in ICT. A large number of the respondents have undergone informal training (learning) which has been defined as: Learning resulting from daily activities related to work, family or leisure. It is not organised or structured (in terms of objectives, time or learning support). IL is in most cases unintentional from the learner's perspective. It typically does not lead to certification (Tissot, 2004).

Batane and Ngwako (2014) in their study of technology use by student teachers during Teaching Practice concluded that the pre-service teachers of today "unlike their predecessors are better placed to integrate technology in their teaching because of two main reasons: 1) technology was part of their training, and 2) they do not have to unlearn teaching habits which have been established over a long time, rather they start off with innovative teaching techniques that support the use of technology" (p. 1). However, the results of this study tend to negate this expectation as most of the teachers between the ages of 20 to 30 years had not received any formal training in ICT; a position that was identified by Chigona (2015) who states that "anecdotal evidence shows that not many are in the position to do so, due to their ill-preparedness from their teacher education" (p. 481).

Some teachers who were interviewed also highlighted some of the shortcomings in their training. For instance, a teacher interviewed pointed out that:

> The training was eratic at college due to the computers that were not functioning properly. We only attended classes for a few days at the beginning and we stopped. Some lecturers explained that it was just for awareness and there was no need to do more. We ended up not learning anything of substance at all. I am lucky because we do not use ICT much at work and where needed my colleagues help.

A Bachelor of Education graduate from the University of Botswana lamented that:

> Although I was given the opportunity to learn about ICT in the following courses at the University of Botswana: ICT 121 and ICT 122; and Com 111 and Com 162. It is also a requirement that students must submit typewritten assignments. We were able to hire people to type for us and write assignments on ICT for us and we ended up with our degrees.

A study by Oloo (2009) found that it was clear that the majority of primary school teachers were ill equipped to effectively integrate ICT in classroom. The main challenge for teachers was lack of adequate number of computers, educational applications, training, policy and strategy on how integration should be done. In short, they are ICT illiterate. This reflects the third dimension of the framework that informs the study. The other thing is that it appears teacher education programmes are not viable enough when it comes to ICT training.

Availability of ICT Hardware and Software

It has been pointed out that Information and Communications Technologies cover among other things "Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services, and other related information and communication activities" (Obota, Oluoch, & Makani, 2015, p.52). Sharma (2003) identified the following as common in schools: teleconferencing, email, audio conferencing, television lessons, radio broadcasts, interactive

radio counselling, interactive voice response system, audiocassettes and CD ROMs, and are used for different purposes in education. Another very important feature in the integration of ICT in education is the availability of infrastructure in the schools. Obota, Oluoch, and Makani, (2015) are emphatic that:

> To support ICT integration in schools, the whole prerequisite hardware infrastructure needs to be in place with the supporting elements such as electricity, maintenance, and technical service. … The basic requirement is appropriate rooms or buildings to house the technology. In schools that have vacant classrooms and or old school buildings, extensive renovation to ensure proper electrical wiring, heating/cooling and ventilation, and safety and security would be needed.

Table 3: Hardware and Software available

Hardware			Software		
	Yes	No		Yes	No
Computer	110	14	Word Processing	62	62
Internet	2	122	Databases	50	74
Telephone	110	14	Spreadsheets	44	80
Video Camera	50	74	Power Point	52	72
Survailance Camera	10	114			
Copier	112	12			
Digital Projector	86	38			
Fax Machine	100	24			
Printer	118	6			
Scaner	44	80			
Official Mobile Phone	32	82			
Electricity Infrastructure	102	22			
TV Set	58	66			

From the findings of this study as illustrated in Table above, 118 (95.2%) had a printer, 112 (90.3%) had a photocopier, 110 (88.7%) had computers meant for curriculum, and 110 (88.7%) had a school telephone. Only 2 (1.6%) of the respondents agree that there is internet in their schools; in spite of the fact that research shows that the Internet has become an indispensable information gateway for many people in the developed world. It has been argued that it has the ability to disseminate, update, and correlate information instantaneously. One positive feature from this study is that 102 (82.3%) of the respondents agree that there is electricity infrastructure in their schools.

From the interviews conducted by the researchers for this study, it became clear that most of the teachers are ICT illiterate in one way or the other as reflected in their responses. For instance one of the teachers interviewed emphasized that:

> There are a lot of (ICT) materials stored in the school office and storerooms
> for security reasons. Since 2012 the Government of Botswana decided to bring
> a lot of ICT materials to all primary schools. The problem is that as teachers
> we do not know how to use them and we also do not know their names. The

few items that I know by names is that there is a printer, photocopying machine and computers. Some of the things are not known by me.

When asked to mention some of the ICT materials they knew by name, one teacher declared:

> The technology materials that we use in our school include: mobile phones, computers, fax machines, printers and the like. These are the things that make our lives as teachers easy. For instance if I want to communicate with a parent I can use my mobile phone; or when I want to give a test I can just photocopy the number of scripts that is enough for all students.

At least the results to some extent show that most teachers in this study had an "up-to date understanding of ICT used in school, workplace, home and community", which is in line with the framework that informs the study. However the majority of them did not know the gadgets which can lead to the conclusion that they are illiterate. This idea of primary school teachers being ICT illiterate was captured by one teacher who emphasized that: "Most primary school teachers are ICT illiterate myself included. I only know how to use my simple mobile phone (sedilame). I rely on my workmates for photocopying and printing".

Uses of ICT in Teaching

Research has shown that teachers need training require training in the application of the various educational software in teaching and learning as well as in computer literacy (Olube, 2006, Khalkhali, Moradi & Amuei, 2008). Teachers need to be trained in how to use ICT as their tools can facilitate training as well as enhancing students' learning and performance. Research shows that "Curriculum management practices that head teachers and teachers can enhance by use of ICT include curriculum delivery, timetabling, student attendance records, students contact details, preparation of schemes of work, development of lesson plans, student assessment progress records and reports, preparation of tests and examinations, allocation of teaching and learning resources, and staff performance records" (Obota, Oluoch, & Makani, 2015, p.53).

Table 4: ICT in Teaching

	Agree	Disagree
Monitoring School Time Table	32 (**2**)	92 (**90 is U**)
Monitoring Schemes of Work	46	68
Monitoring Students' Reports	60	56
Analysis of Results	46	66
Research Purposes	36	82
Procurement of Books	22	88
Staff Personal Information	38	76
Students' Attendance	22	94
Keeping Students' Data	20	96
Communication with other staff	24	96
Correspondence with Region	8	110
Use Whattapp with parents	2	116
Correspond with Colleagues	4	114

From the findings of this study, it is clear that teachers use ICTs for various reasons and mostly for academic purposes. In schools gadgets such as computers may be used for typing examinations and this can very helpful since the examinations can then be easily moderated through editing. Computers can also be used for storing students "scores for all exams done while in the school, which makes it is easy to track the academic progress of a student over time and advise him accordingly. From this study, 60(48.4%) of the respondents believe they use ICT to monitor students' progress reports. Forty six (37.1%) use it for the analysis of results. The use of ICT for school timetabling from the results of this study reflect the situation in the primary schools in Botswana, especially in the rural areas. This situation may mean that the literacy levels of those tasked with timetabling is low or absent or there are no relevant equipment. Obota, Oluoch, and Makani (2015) are of the view that ICT can be used to accurately capture all subjects and their time allocation; it can be used to keep a detailed record of the academic level and experience of all members of staff; and it can be used to indicate the rooms to be used for particular subjects.

A Bachelor of Education graduate from the University of Botswana explained that:
> Although I did ICT such as word processing, excel and spreadsheet (sic) at the University there are still some challenges. There are no adequate resources and time is not on our side as teachers. Even making notes for pupils is not possible. I depend on the chalkboard and manilla 90%. I only use computers to do/when dealing with tests. I also use the printer and photocopying machine. That is really where we use ICT skills and knowledge.

Information technologies facilitate students in their learning process through their active participation on one hand and help teachers on the other hand. These findings show that the majority of the teachers in the sample do not utilize ICT in their work. However, as some teachers use ICT as shown in the results reflects the second dimension of the framework that informs this study "where the role of the teacher is to design, facilitate and scaffold student enquiry, by making informed choices about the relevance and responsiveness of ICTrich learning experiences to the diverse needs of learners, and the context of living and learning in the contemporary world" (Dakich, 2005, p.5). The study findings also show that most of the teachers in the primary schools in the Bobirwa Cluster are not literate enough to integrate ICT into everyday practices. They are not using applications such as WhatsApp, and do not use ICT to correspond with colleagues and even the Regional Offices. This can only mean that they are illiterate.

Challenges facing Literacy Development
There is a plethora of factors that hinder the educators' use of ICT and subsequent integration of technology into their teaching and learning. Some of these factors have been identified as including teachers' readiness, confidence, knowledge and ability to evaluate the role of ICT in teaching and learning, and lack of skills to be able to use the ICT equipment (Manson, 2000; Lau & Sim, 2008). Chigona and Chigona (2010, p.3) explain that: "Other significant factors are the teachers, curriculum planning, technical support, the students, the actual use of ICT, training and personal development, the school council, the budget and the learning technologies committee".

Table 5: Challenges

	AGREE	DISAGREE
Financial Constraints	102	18
Lack of Time	98	20
Lack of ICT Infrastructure	104	14
Negative Attitudes	46	64
Lack of Interest	46	60
Fear	56	50 **(18 U)**
Lack of Knowledge and Skills	90	26

In this study the following factors were investigated and as shown in Table above, 102(82.2%) of the respondents believe that financial constraints are one of the factors hindering ICT among primary schools. Another factors that was highlighted in the study is that of lack of ICT infrastructure which was identified by 104(83.9%) of the respondents. Other major factors include Lack of time 98(79%), Lack of Knowledge and Skills 90(72.6%), Fear 56(45%), Negative attitudes 46(37.1%) and lack of interest 46(37.1%).

A teacher interviewed pointed out that:

> In our school there is only one functioning computer (desktop) for the higher office. Debswana donated three computers which never worked. The school used a lot of money to collect the computers from Gaborone and making some repairs until it was realized that they will never work. The Ministry of Education and Skills Development provided all primary schools with a big multipurpose photocopying machine. The problem is that the Ministry of Local Government is refusing to service it and it is not working to its fullest capacity.

Information and communications technologies are a very expensive venture. Schools need more funds to manage ICTs in the schools and this can be a challenge as the budgets are really tight in the schools. Funds are needed for purchasing and installing the equipment, buying software, training teachers, and supporting, maintaining, and using the equipment. Budgets for ongoing equipment support, supply, repair, and replacement often are neglected or insufficient. As for lack of time, in primary schools teachers teach all the subjects and using technology is demanding on the side of time. Teachers will still be expected to keep their workloads and sometimes will have to do extra technical work due to ICT.

Benefits of ICTs in education

It can be argued that Information and Communication Ttechnologies have the potential to innovate, accelerate, enrich and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthen teaching and helping schools. With sufficient funding, and under the right conditions, with highly skilled teachers, classroom-based ICTs can have a significant impact on the quality of teaching and learning. In the era of information technologies students should be able to apply core concepts and generalize principles to significantly different situations. Exposure to information technologies leads to this affective principle. A teacher interviewed suggested that: "More workshops and in-service training can help improve the ICT literacy of the teachers".

Conclusions and Recommendations

Research has shown that Computer and information literacy refers to an individual's ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in society. Form the findings of this study, it can be concluded that the teachers who participated did not have the capability to utilize computers and other ICT materials to support their teaching as the majority disagreed that they use ICT to monitor the school timetable, the schemes of work, monitor students' progress and analyzing students' results. Like in most developing countries, teachers' capacities to use technology are enhanced through vibrant ICT training programmes for teachers.

From the findings of this study it is clear that primary school teachers in the Bobirwa Cluster are ICT illiterate as they were not adequately trained in the area; they lack knowledge and skills of ICT; and they do not use ICT in their teaching due to reasons such as lack of materials and internet. They are illiterate because they are not able to use digital technology, communications tools and networks to access, manage, integrate, evaluate and create information in order to function in their profession of teaching. They are unable to integrate ICT in teaching and learning due to the shortcomings highlighted in the study. Primary school teachers in the sample lack confidence, experience, and pedagogical understanding in mobilizing the potential of digital technologies in their teaching and learning. ICT literate teachers should be able to use technology as a tool to research, organize, evaluate, and communicate information and the possession of a fundamental understanding of the ethical/legal issues surrounding the access and use of information. But the teachers in the sample cannot be said to have such abilities.

The results also show that most of the teachers in the primary school have received informal training. It can be concluded that while many ICT skills are acquired outside of the formal teacher training system, additional effort needs to be made to make ICT a mandatory rather than optional part of the curriculum.

It is recommended that Government invests more funds in developing ICT in the schools. Teachers need to be sent to school to pusue further studies in ICT. Teacher education programmes need to be improved in all aspects, including the capacity of the educators themselves to deliver vibrant programmes in ICT.

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SLEND SIGN LANGUAGE TO ENGLISH BY THE DEAF: LITERACY DEVELOPMENT WITH DEAF COMMUNITIES USING SIGN LANGUAGE, PEER TUITION, AND LEARNER-GENERATED ONLINE CONTENT

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Abstract

This paper reports on a project designed to enhance the employability and wellbeing of a marginalised community: the Deaf[1]. It is funded by the Economic and Social Research Council/Department for International Development in the UK (ES/M005186/1). The project adopts a Deaf-led approach to developing English literacy. This one year project features the development of an online platform: Sign Language to English by the Deaf (SLEND). The project's ethos stems from a conviction that learning is situated in the demands and contexts of everyday life. People's learning will develop optimally in situations where their existing purposes and abilities are recognised, and where they can collaborate, including with peers. Nowadays, online environments are significant in everybody's everyday lives and offer particular opportunities for the Deaf to participate.

This paper explains how the project has been piloted in five centres in India, through a combination of peer to peer face to face and online activities. The different groups contribute their learning activities to the SLEND, finding value in both process and sharing outcomes.

The project includes research in Uganda and Ghana, among Deaf communities. This paper reports on the first elements of the research in those locations. Data were collected using intensive focus groups. Processes of recruitment and activities are described.

Findings of this research show how access to the internet is particularly important for the Deaf, including the improvement of their literacy development. The findings suggest the fruitfulness of an approach to Deaf people's English literacy needs. It recommends capacity building that is grounded on a "real literacies" approach, which is firmly rooted in an understanding of the place of English literacy in their lives. It also recommends the opportunities that exist for enhancement of their communicative capabilities and social participation in all spheres of life.

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[1] Ladd (1995) distinguishes 'deaf' from 'Deaf'. By the lowercase 'deaf', it refers to those who experience deafness since an early or late life, resist to sign languages and prefer the majority society for socialisation. Whereas the uppercase 'Deaf' indicates those with 'hearing loss' ever since born or early (sometimes late) childhood, appreciate the sign language, communities and cultures of the Deaf, perceive themselves as similar to other language minorities.

1 Introduction

This paper is about an innovative project, Literacy development with deaf communities using sign language, peer tuition, and learner-generated online content – sustainable educational innovation. This project has been piloted among marginalised deaf youth in India. It also has research elements in Ghana and Uganda with the ambition to produce outputs that will be of relevance in more countries, in Africa and beyond. This project explores ways of improving the English literacy and communication skills of deaf young people, to enhance their employability, wellbeing and life prospects. We have designed an online platform called "Sign Language to English by the Deaf" (SLEND).

The project is led by Professor Ulrike Zeshan of the International Institute for Sign Languages and Deaf Studies (iSLanDS) at the University of Central Lancashire, UK (UCLan). She is supported by other academics and learning technologists at UCLan and Lancaster University and leads a team of research assistants and peer tutors in India. In Ghana the research assistant is Marco Nyarko and in Uganda Noah Ahereza.

The project is funded by the UK's Economic and Social Research Council (ESRC) and the Department for International Development (DFID) "Raising Learning Outcomes in Education Systems". The project is set to run from June 2015 – July 2016. Full ethical approval was gained from UCLan and Lancaster University. This paper reports on some preliminary findings of the project, that is: the design and implementation of the SLEND in India, with a brief evaluation of the first six months, and the first research activities in Ghana and Uganda which comprised of focus groups.

2 Background

The World Federation of the Deaf estimates that 80% of the world's 72 million Deaf sign language users live in developing countries. Only 3% of all Deaf signers worldwide have access to education through sign language as advocated in the UN Convention on the Rights of Persons with Disabilities (UNCRPD). Adopting the views on empowerment approaches to Deaf communities as expressed by Ladd (2003) and Bauman and Murray (2010) we take the views that radical educational changes are best driven from within Deaf communities. This motivates the project's Deaf-led approach with the focus on Deaf learners, community teachers, local trainers, all dynamically interacting within learning and research community. A further aspect of this study is the commitment towards sustainability of the development of digital and mobile forms of learning and teaching that are cost-effective and adaptable to different contexts.

3 Aims

The project aims are:

- to develop and provide a peer-led English-literacy teaching programme for members of the Deaf community in India;
- to undertake pilot work, ascertaining the potential transferability of our approach to other Deaf communities, in Ghana, working with Lancaster Ghana, and with the Uganda National Association of the Deaf;
- to develop the SLEND, Sign Language to English by the Deaf, e-learning platform, to be used both in conjunction with face-to-face tutor-led teaching and for self-study;

- to develop and implement a model of learner-generated and needs-driven curriculum;
- to draft a model of effective language-teaching interventions to guide policy and further innovation;
- to design an adaptation of the Common European Framework of Reference for Languages (CEFR) for the expression of learning outcomes;
- to produce a diverse range of dissemination and knowledge exchange outputs, engaging with policy-makers, practitioners and academic communities.

4 Research and development

4.1 Ethnographic approach to real literacies

Instead of traditional language teaching, this project takes a learner-driven and ethnographic approach, exploiting a virtual/mobile learning platform and supporting Deaf peer tutors and learners to develop their own materials and strategies, including teaching through sign language. Learners focus on functional aspects of English, which means using it to accomplish everyday purposes. This was to ensure responsiveness to learner needs and to allow the researchers to build on the skills available amongst the Deaf community with teachers and learners supporting each other, hence the principle of peer tutoring. Our approach draws on concepts of place-based collaborative ethnography and learner-generated curricula (Comber, 2016). The guiding principle is that we focus learning on real language and real literacy and develop the curriculum together with the learners. The real literacies approach (Street, 2012), originally developed for adult literacy learners, postulates that learning is most useful if based on authentic texts and practices. The aim is that students learn on the basis of activities, situations and texts which they would come across in real life and which are of immediate relevance to their lives. In the contemporary world, many of our purposes are accomplished online; so online is both a site for authentic practices (such as the use of WhatsApp) and offers an opportunity for the development of a project-specific online space such as SLEND.

4.2 Technology and Deaf Education

Information and Communication Technology (ICT) plays a crucial role in transforming communication and education. This is the case for the linguistic and cultural minority, the Deaf community, in terms of technology-assisted communication and education. On the one hand, to break down communication barrier with their peer and hearing people who have no knowledge of sign languages, Deaf people tend to resort more to Computer-Mediated Communication (CMC) (Garberoglio et al., 2015), such as email, blog, instant message and text. On the other hand, technology-assisted teaching and learning enhances Deaf learners' information and knowledge processing and retention (Sadoski & Paivio, 2004) through a combination of visual and verbal information; motivates Deaf learners (Beal-Alvarez & Cannon, 2015); and improves their learning outcomes (Beal-Alvarez & Easterbrooks, 2013; Cannon, Fredrick & Easterbooks, 2010; Cannon et al., 2011).

A typical element in technology-assisted educational transformation for the Deaf is an e-learning platform. Numerous studies in developed countries (Bates, 2005; Wang, 2006; Pandian, 2006; Long et al., 2007; Lang & Steely, 2003; Mertzani, 2006; cited in Denmark, 2013) have been conducted and positive results have been found on the facilitating role of these e-learning platforms for Deaf learners developed with different software such as Moodle, MOOC, Sakai and Joomla. It is only recently that research (Denmark, 2013;

Sahasrabudhe, 2010) on English Learning Platform for the Deaf in the Global South has emerged. Nevertheless, these e-learning platforms are developed and maintained by hearing teachers and organizations. It is possible that they may not fully reflect Deaf learners' needs; further, without continuous human and financial input, sustainable development of the platform may not be feasible. This project's platform, SLEND, aims to bridge the gaps and establish an eco-learning system.

4.3 SLEND: Key Characteristics and Components

In analogy with a natural ecosystem, the ecosystem of a virtual learning environment aims to be a self-sustaining system that learners can interact with, achieving their learning objectives with the learning resources and activities available. In line with this notion, to set up a Virtual Learning Environment platform for Deaf learners of English literacy, SLEND embraces the following characteristics:

- **Technology-Assisted**: The SLEND is a Moodle-based VLE platform and can be used on different digital devices, such as computers, laptops and mobile phones. At the meantime, a Computer Mediated Communication tool, WhatsApp Group Chat, is used for instant communication, information and knowledge sharing at any time anywhere. Finally, a series of Deaf-friendly techniques, such as captioning, pictures and signed videos, are included in the platform.
- **Peer-to-Peer:** Peer-to-Peer is a system suited to an e-learning ecosystem as it allows each learner to act as a service user and also as a service provider (Leong & Miao, 2008). Deaf peer tutors and learners are the key content developers and users of the SLEND. Deaf organizations and Deaf research assistants monitor and support the development.
- **Sign Bilingualism:** Viewing the Deaf community as a linguistic and cultural minority (Ladd, 2003), an approach of sign bilingualism is adopted to encourage the use of sign language as the language of instruction and to respect, indeed to enhance the further enrichment of Deaf cultures while learning English literacy.
- **Functional Literacy:** Marschark, Lang & Albertini (2002) suggest that it might be pointless to adhere to the language order for language teaching for young adults as their previous language learning experience can affect and compensate for their developmental order of language. Rather, the content and function should be the focus. Therefore, the SLEND adopts a functional literacy approach. All the learning materials are collected from Deaf learners' real life by utilizing an ethnographic technique, clock activity. A Freirean approach is also followed to encourage peer learners to bring real-life English to the class.
- **Common European Frame of Reference (CEFR) Benchmarking:** A modified CEFR for Languages is used to guide learning and assess learning outcomes. This enables Deaf learners' English literacy growth benchmarking against an internationally recognized scheme for the first time and motivates Deaf learners in the way of benefiting their further education and future employment.

Operationalisation of SLEND

Guided by the characteristics, the SLEND comprises of *General Introduction*, *Our Sharing Space*, *Real Life English Topics*, *Grammar*, and *Main Glossary*. Among them, *Real Life*

English Topics is the key component for learning to take place. It consists of learning sessions which are developed by Deaf peer tutors and learners themselves.

P2P Deaf Literacy

Welcome

Please click on the box below to view the sections that you are looking for:

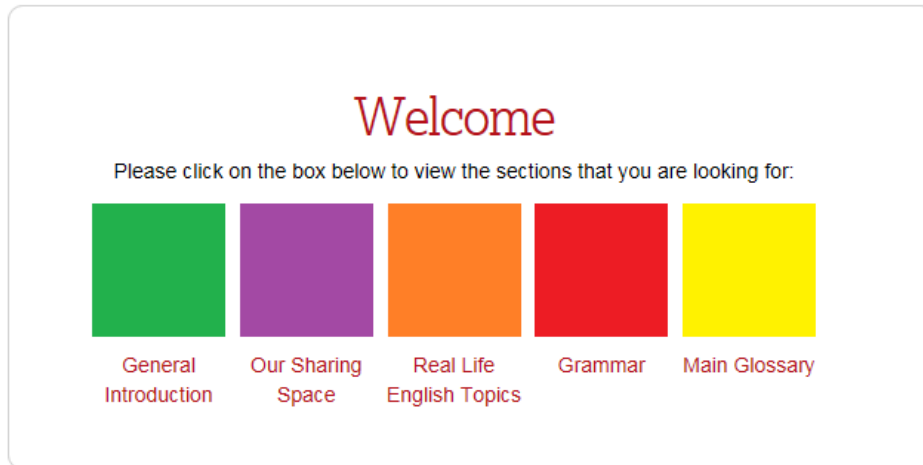| General Introduction | Our Sharing Space | Real Life English Topics | Grammar | Main Glossary |

Figure 1: Key Components of the SLEND Platform

Table 1: Key Elements of a Session

For each session, the learning flows in the following structure:

Elements	Moodle Activity	Description
1. Real Life English Materials	Database Activity	Learners and Peer Tutors upload materials from Real Life to learn.
2. New Vocabulary	Secondary Glossary	Learners and Peer Tutors can upload their new words, share with other students.
3. In-Class Video	Page Activity	Peer tutors from different learning centers film the discussion or explanation during class and share it on the platform.
4. Useful Language	Lesson Activity	A series of explanation, activities and quizzes to practice useful language distilled from real life.
5. Extended Exercise	Quiz	Exercise for the whole session.
6. I/We can …	Checklist	Learners check off what they have learnt.

4.4 Piloting of the SLEND in India

The SLEND was introduced into India at the beginning of the pilot project. Fifty Deaf adult learners (aging from 18 to 28) and five Deaf peer tutors enrolled from five different areas of India. They have two-hour laboratory collaborative learning and two-hour classroom learning each day, five days a week excluding holidays. The learning commenced at the beginning of September, 2015 and will end in April, 2016.

The implementation of the SLEND has challenges relating to technological barriers to implementation locally. These include at various times: lack of computers, laptops, limited access to internet, slow internet, etc. The project's collaborative ethos is expressed through taking whatever measures are situationally appropriate to mitigating against such obstacles, for example sharing computers and laptops; sharing internet from Deaf NGOs.

Although at the time of writing the pilot project is still underway, already rich data is emerging, revealing both participants' experience and their feedback. So far around forty sessions have been developed by the peer tutors and learners with a wide range of real-life topics, such as in the bank, at the railway station, forms, signs, (online) shopping, news, headlines, sports, invoices, etc. The well-developed sessions are grouped and sequenced for ease of access.

Both groups of Deaf peer tutors and learners produce positive responses about learning on the SLEND. Deaf peer tutors have benefited from attending training. In developing learning content and sharing knowledge with learners, their own literacy skills have been improved. They have become more motivated and confident for learning and teaching. Now and then, they experience difficulties in explaining new knowledge to peer learners. Then they resort to tools such as (online) dictionary, Google, discussing with one another and collaboratively acquire new knowledge.

As for Deaf learners, they provide feedback on the SLEND and acknowledge it to be very helpful and useful for English literacy attainment. Firstly, by providing real-life materials, the SLEND meets their daily English communication needs. Secondly, they feel comfortable, motivated and confident while learning with their peers and seeking help from peer tutors. This is aligned with the findings from previous research (Cannon and Guardino, 2012; Denmark 2013; Sahasrabudhe, 2010) that plead for peer tuition and support. Finally, Indian Sign Language (ISL) in the form of videos on the SLEND. Such mediated interaction is viewed as an efficient tool for English learning in terms of ensuring better communication and enhancing understanding.

5 Experiences in Uganda and Ghana

A range of activities in each of these countries has taken place, including two focus groups and a dissemination workshop. Although activities in these countries is small-scale, being the outcomes of work by one research assistant in each place, rich data has been obtained as to the experiences of Deaf people in everyday life, in schooling, their needs, reflections on practices and opinions on glimpses of the SLEND. The scope of this paper is limited to data from the first focus group in each location, and then further to include just some indicative data regarding Deaf people's experiences of English literacy in everyday life and schooling that have bearing on the present project.

5.1 Recruitment to the focus groups

The project's partner in Uganda is the Uganda National Association of the Deaf (UNAD). Recruitment to the focus group was achieved through personal recruitment by the first author, a project Research Assistant who is also UNAD's Sign Language Program Coordinator. He focussed on personal recruitment through Deaf-led events including a workshop on political awareness organised by a deaf Member of Parliament and a regional Deaf football challenge cup. The 19 participants were all young Deaf adults: 2 teachers of Deaf children, 1 IT teacher of young Deaf people, 5 sign language instructors, 3 university students, 1 college student and 2 high school students from a secondary school for the Deaf, 1 community worker, 1 business professional and 3 UNAD staff members. In Ghana the Research Assistant, the second author, is based at Lancaster University Ghana. He used his networks in the Eastern region of Ghana to recruit participants. The 12 participants included: 3 Deaf teachers at Demonstration School for the Deaf Mampong-Akuapem, 4 students at Senior High Technical School for the Deaf, Mampong-Akuapem and 5 members of the Ghana National Association of the Deaf, Eastern Region.

Both events were filmed. At each session, information about the project was discussed and consent to participate obtained and recorded. There were two main activities conducted by the focus groups.

Activity 1: English around the clock

The purpose of this activity is to explore English language practices participants are already engaging in. This can increase awareness of the range of contexts and activities people are already experiencing and indeed sometimes enhance confidence in itself. In the clock activity (Ivanic et al. 2009) participants record their own uses of English literacy through a typical day. It can be challenging to identify these but working and discussing in small groups can be built upon to create lists.

Activity 2: Discussion

Divided into small groups, the participants shared their findings and then brought them to the whole group. The focus group discussed current uses of English literacy in everyday life, obstacles and barriers for themselves and other Deaf learners.

5.2 Findings from Uganda

English literacy is important to all participants

In Uganda English is an official and national language that is used everywhere. Many participants use English for participating in educational institutions, whether teaching or learning. Many use English in the course of their work. People use both print material and online. While their Hearing counterpart are taught several languages in schools, Deaf are only taught English alongside sign language. Therefore, English is the only mode to bridge communication barrier between them and Hearing people who do not know sign language. Although two participants denied that they used written English often in their lives, further probing ascertained that English is used in many situations. A minority of Deaf people do prefer to stress their main communications is in sign language.

English is used online, for everyday communications, leisure and in the workplace

All participants use written English on social media platforms such as WhatsApp and Facebook for communicating among friends and families and for organising events. Google search engine and email are also used including to access information. Workplaces often demand online use of English.

Facing and overcoming challenges to developing English literacy

Many participants expressed concerns over lack of confidence in English grammar. Some observed they felt much weaker in writing in comparison to reading. Using English in informal contexts such as social media can bolster confidence, although this does not necessarily translate over to workplace use of English. Participants use a range of strategies to assist them to overcome challenges including practicing reading, using dictionaries, online translation tools and asking people for help. Almost all participants agreed that peer tutoring is necessary and desirable, relating to personal experiences at school where they obtained assistance from their peers. They argue that they are shy to ask people whose age is way above their or teachers who will only complain that they are slow learners. Experience with peer Deaf tutors can therefore be very helpful.

Figure 2: Focus Group, Uganda.

One of the participants is giving a plenary presentation from his group. He is using an example of the clock activity on the flip chart. The walls are plastered with posters of different scenarios where English may be used by Deaf participants in their everyday lives including social media platforms and physical settings.

5.3 Findings from Ghana

English literacy is important to all participants

Reading in English is a very important activity. The Bible is an important and regular activity for most. Everybody uses English in many aspects of their daily lives, in restaurants, homes, markets and everywhere they find themselves. People use news websites to access the news. English subtitles are provided on films. People have used English at schools.

Written English is used often by all participants. All participants use English in order to engage in society and understand their environments. They use it to interact with those in their families and communities who have no sign language background. Pen and paper conversations are frequent. Written English is taught at school.

English is used online, for everyday communications, leisure and in the workplace

In Ghana English is an official and national language that is used everywhere. Most participants use written English through phones, sometimes, for a minority, smartphones. They read and write text messages (short message services SMS), use WhatsApp and use the internet to access information. The cost of digital media is an issue, as internet data bundles are expensive. But people who can afford to prioritise daily use. Students emphasised their use of digital media for research purposes. They also use digital media to work in pairs and in groups, for example connecting through WhatsApp or Facebook Messenger.

Facing and overcoming challenges to developing English literacy

The structure of sign language and English language differ significantly. This causes considerable obstacles for Deaf people in learning English. There are considerable problems facing the Deaf in education. Methods of teaching and assessment are inappropriate. The Deaf therefore run the risk of being left behind in terms of functioning effectively in society and gaining employment. A particular problem reported by the majority is difficulty in communicating effectively with health services. In their endeavours to overcome such barriers Deaf people report that informal support is very important. Peer to peer support is significant both within and beyond formal education.
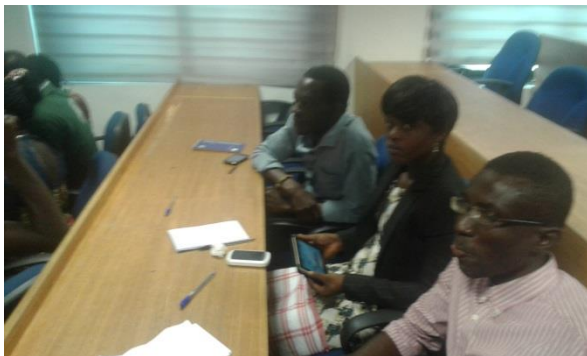

Figure 3 Focus Group, Ghana: participants with mobile technology.

6 Conclusions

Access to the internet is particularly important for the Deaf, including to improve their literacy development. Wherever access to online platforms and services is available, Deaf people make use of opportunities to participate in interactions online, and develop their knowledge and understanding. English literacy is vital to employability and participation as an aspectof everyday life in the countries where the project is active. Sign languages, as the first languages of Deaf people, are greatly valued as an aspect of their culture. The lesson learned from the experiences of piloting the project in India is that the project, with its blend of face to face peer tutoring and online activities, is an effective means of developing English

literacy, enhancing bilingualism and promoting appropriate technological skills in Deaf learners and their tutors. Research conducted in Ghana and Ugandaof the first stage confirm the current importance of English literacy in Deaf people's lives. The potential for further development of their capacity, is evident, including through the incorporation of online activities, peer tutoring and attention to authentic purposes for English literacy in their everyday lives.

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PERSONAL ATTRIBUTES AS CORRELATES OF THE USE OF THE INTERNET BY DOCTORAL STUDENTS IN KAMPALA INTERNATIONAL UNIVERSITY

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Abstract
The study intended to establish the extent of use of the Internet by doctoral students in Kampala International University (KIU) and how that use was related to the personal attributes of a given student, namely the student's level of interaction with information and communication technology (ICT) change agents, training in ICT, cosmopolitanism, age, gender and income level. The cross-sectional study involved 45 respondents who completed a questionnaire, whose validity and reliability were duly tested using factor and reliability analyses. Descriptive summary statistics (means and standard deviations) were used for descriptive analysis, while regression analysis was used at the inferential level to test the study hypotheses. The main findings were that all the personal characteristics were not significant correlates of the use of the Internet, except age, which was a significant negative correlate of the use of the same. The study thus led to recommendations, one of which was that relevant stakeholders such as the University's Directorate of ICT Support (DICTS) ought to give preferential encouragement and/ or assistance to the aged and ageing doctoral students with regard to the use of the Internet.

1   Introduction

Eyitayo (2008) defines the Internet as a "world wide, publicly accessible network of interconnected computer networks… that consists of millions of smaller domestic, academic, business and government networks, which together carry various [types of] information and [offer] services such as electronic mail, online chat, file transfer, and… web pages" (p. 31). In terms of importance, Kok, Kee, Ping, Khalid and Yu (2011) observe that "the Internet represents an extremely efficient medium for accessing, organizing and communicating information…. Compared with other means of communication such as the post, telephone and fax, the Internet provides a flexible, reliable and low-cost method for communication…." (p. 302). Specifically, regarding the utility of the Internet in Education, sources such as Agbonlahor (2006) observed that institutions of higher learning can benefit greatly from the Internet in several areas including literature search, communication and entertainment.

Agbonlahor (2006) elaborated that academics can use the Internet to conduct literature searches for research on any topic say from virtual or electronic or digital libraries, thus enabling lecturers to do constant updating of their notes. The Internet facilitates communication in several ways including the most fundamental, namely e-mail, defined as sending messages electronically say for academic purposes. Such communication can facilitate on-line supervision where a student and supervisor can exchange a dissertation or

thesis electronically without physically meeting. The Internet is also a leisure tool as it provides a number of entertainment/ leisure sites. Unfortunately however, the use of the Internet by students in universities in East Africa has consistently been reported to be very low.

Moodie (2010) in the *University World News: Africa Edition* newspaper of November 28, quoted a study report released by the Association of Commonwealth Universities (ACU), as reporting that "East African universities have more journals and scholarly research available to them [online] than ever before, yet staff and students do not appear to be accessing these resources enough". This failure to make optimal use of ICT in a given university leads to several undesirable outcomes such as wastage of funds the university has sunk on underutilized or even unutilized facilities. For example, funds that were budgeted by Kampala International University (KIU) towards "website and internet expenses" during the October 2008 to September 2009 period as per the University's Strategic Plan, 2008/ 09 – 2012/ 13 was USh 1.44 billion (Kampala International University, 2008). This large sum of money is testimony that KIU has committed large sums to the cause of ICT. It was therefore appropriate to isolate the reasons why students in KIU, one of the universities in Uganda, were/ are slow to embrace the use of the Internet.

2   Theoretical Framework

The theoretical basis for this study was Rogers' Innovation Diffusion Theory (IDT). Rogers (2003) conceptualizes an innovation as an idea, practice, or object perceived as new by an individual. Thus the innovation of interest in this study was the Internet. Adoption, according to Rogers is preceded by diffusion of an innovation. He hence defines "diffusion" as a process in which an innovation is communicated through certain channels overtime among members of a "social system", that is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. In other words, a "social system" is an organization of interest. In this study, the "social system" of interest were the doctoral students in Kampala International University (KIU). "Adoption" according to Rogers, is the decision to make full use of an innovation as the best course of action available, while "rejection" is a decision not to adopt the innovation. Given that the process of diffusion and/ or adoption of innovations is always slow (Rogers, 2003), one goal of diffusion and/ or adoption research is to try to expedite the process. One way to expedite the process is to identify its correlates, that is factors affecting it, which correlates may be manipulated to positively influence the diffusion and/ or adoption of the innovation in question (Rogers, 2003; Schiffman & Kanuk, 2004).

In deriving the correlates of innovation diffusion and/ or adoption, several frameworks are available. However, in this study Rogers' Innovation Diffusion Theory (IDT), was used. IDT relates innovation diffusion and/ or adoption to three categories of correlates, namely characteristics of the individual potential adopter; how the adopter perceives the innovation; and the characteristics of "social system" or organization where the potential adopter is. Of relevance in this study is the stipulation by Rogers' IDT to the effect that an individual's propensity to adopt or use any innovation such as the Internet, depends on the individual characteristics of that person. Such characteristics include the extent to which that person interacts with change agents or champions of relevance to the innovation in question; the level of training of relevance to the innovation the person has received; how cosmopolitan (i.e. non-conservative) the person is; how old the person is; the gender and income level of

the person. Hence, this study was intended to establish the extent to which the use of the Internet by doctoral students in Kampala International University (KIU) related to the personal attributes of a given student, namely the student's level of interaction with information and communication technology (ICT) change agents, training in ICT, cosmopolitanism, age, gender and income level.

3   Derivation of Hypotheses Framework

3.1   Interaction with Change Agents as a Correlate of Use of Innovations: Stuart, Mills and Remus (2009) define champions, another term for change agents, as individuals who emerge to take creative ideas and bring them to life; who actively and enthusiastically promote an innovation, building support, overcoming resistance and ensuring that the innovation is implemented (p. 734). They (Stuart et al., 2009) observe that champions can be distinguished from non-champions because they can communicate a clear vision of an innovation, display enthusiasm for the innovation, demonstrate commitment and involve others in supporting it. They add that "confidence, persistence, energy and risk-taking are… key characteristics of champions" (p. 734). They go on to stress that "champions are… likely to have a variety of working experiences and a long tenure in the organization to draw from…. This helps them to understand the potential of [say] new technology while giving them a broad social network to help them to implement and support the change…." (p. 734). Studies positively relating the interaction with ICT change agents or champions and the use of ICT innovations by university students can be found (e.g. El-Gayar, Moran & Hawkes, 2011). But so can studies (e.g. Bakkabulindi & Kabasiita, 2012) not supporting the postulate. Thus it was incumbent upon the current study to contribute to the clarification of whether:
H1:   Interaction with ICT change agents was a positive correlate of the use of the Internet.

3.2   Training as a Correlate of Use of Innovations: Ng'ethe, Iravo and Namusonge (2012) define "training" as a form of human capital investment, which provides employees with specific skills or helps to correct deficiencies in their performances. They contend that the purpose of training in the work context is to develop the abilities of the trainee and to satisfy the current and future human resource needs of the organization. Sinha and Sinha (2012) on their part observe that, the situation where all employees have "access to training… programs is critical in facilitating organizational growth, particularly with… technological improvements" (p. 149). Thus training in ICT is a key factor to the successful integration of computers and other technologies into study and/ or work environments. Among the recent past researchers, there are some (e.g. Gakibayo, Ikoja-Odonga & Okello-Obura, 2013; Khan, Bhatti & Khan, 2011; Okello-Obura & Ikoja-Odonga, 2010) that established training to be a positive correlate of the use of innovations by university students, and those (e.g. Bakkabulindi & Kabasiita, 2012) that did not. Such empirical controversy, made it imperative for the current study to test whether:
H2:   ICT training was a positive correlate of the use of the Internet.

3.3   Cosmopolitanism as a Correlate of Use of Innovations: Rogers (2003) defines "cosmopoliteness", another version of the term "cosmopolitanism" as the "degree to which an individual is oriented outside a social system" (p. 290). Rogers further asserts that the earlier adopters are more "cosmopolite" or cosmopolitan than the late adopters, meaning that the earlier adopters' interpersonal networks are more likely to be outside, rather than within, their system. They travel widely and are involved in matters beyond the boundaries of their local system" (p. 290). The earlier adopters act like the "stranger", whose special perspective

stems from a lack of integration into the local system. The "stranger" is not radically committed to the unique ingredients and peculiar tendencies of the group, and because of this social distance from others in the system, the "stranger" is relatively free from the system's norms. This orientation frees the earlier adopter from the constraints of the local system and allows him or her personal freedom to try out previously untried ideas. In this study it was assumed that "cosmopoliteness" is synonymous with "urban influence". Studies positively relating "cosmopoliteness" or urban influence and the use of ICT innovations by university students could be found. For example Amutabi and Oketch (2003) in their qualitative study based on documentary analysis, used the lack of "cosmopoliteness" to explain why the use of the African Virtual University (AVU) in Kenya had not succeeded. Similarly positive results were registered by Bakkabulindi and Ssempebwa (2011). Thus from the literature, the following research hypothesis was in order:

H3:   Cosmopolitanism was a positive correlate of the use of the Internet.

3.4   Age as a Correlate of Use of Innovations: Schiffman and Kanuk (2004) observe that the age of the consumer innovator is related to the specific product category in which the consumer innovates, with the consumer innovators tending to be younger than the late adopters because many of the products selected for research attention such as fashion and automobiles, are particularly attractive to the young consumers. Kok et al. (2011) while quoting relevant studies propose that "youthful managers are more appealing to fresh and unique ideas, and more willing take risks than older managers. The older managers are slow to adopt new technology unless they believe that there is an advantage in adopting the new technology" (p. 303). Several studies have established age to be a negative correlate of the use of innovations by university students. This has been true for Bakkabulindi and Kabasiita (2012), for example. Yet other studies (e.g. Educause Centre for Applied Research, ECAR, 2010) did not find age to correlate with the use of innovations by university students. Thus as Rogers (2003) observes, "there is inconsistent evidence about the relationship of age and innovativeness" (p. 288), that is readiness to use innovations. Hence, it was still necessary to test the hypothesis to the effect that:

H4:   Age was inversely related to the use of the Internet.

3.5   Gender as a Correlate of Use of Innovations: Gender refers to the socially constructed differences and distinctions between men and women. Gender differs from sex in that it is not biologically determined. Gender distinctions include the different attributes, statuses, roles, responsibilities, and potentialities as well as their access to and control over resources and benefits (Ssali, Ahikire & Madanda, 2007). Dlodlo (2009 p. 173) captures very well the phenomenon of how women's responsibilities for family life curtail their abilities to be as technology-savvy as their male counterparts, thus:

Women are responsible for family life. The triple workloads of domestic, income generation, and community management activities mean that women often do not have free time to travel, learn about, and use ICT. It is a challenge [for them] to balance family life and [ICT] training….

Sang, Valcke, van Braak and Tondeur (2010) while acknowledging the general belief that ICT is male domain, do not fully concur with the observations by Dlodlo (2009) regarding ICT as a male domain.

They observe that while:

There is a significant body of evidence supporting the notion that gender plays a role in actual computer integration…. [However] since technologies have become a normal part of the working place setting, a number of researchers argue that computing should no longer be regarded as a male domain (p. 104).

Studies on gender as a correlate of the use of ICT innovations by university students (e.g. ECAR, 2010; Huang, Hood & Too, 2013) and other stakeholders in Higher Education (e.g. Sim, Tan, Ooi & Lee, 2011) could be found. However, there were studies that totally dismissed gender as a correlate of use of ICT innovations by university students. Examples of these include Kalanda, 2010; and Sang et al. (2010). Thus the gender and the use of innovations equation was not free from controversy, making it right for this study to still test whether:

H5:   Gender related to the use of the Internet in such a way that the males were more frequent users.

3.6   *Income Level as a Correlate of Use of Innovations:* Rogers (2003) poses a rhetorical question, namely "do innovators innovate because they are richer, or are they richer because they innovate?" (p. 288). While regretting that "this cause-and-effect question cannot be answered solely on the basis of available cross-sectional data" (p. 288), he noted that "there are understandable reasons why social status and innovativeness vary together. Some new ideas are costly to adopt and require large initial outlays of capital. Only the wealthy units in a system may be able to adopt these innovations" (p. 288). Studies (e.g. Bakkabulindi, Sekabembe, Shopi & Kiyingi, 2009) on income as a positive correlate (or cost as a negative correlate) of the use of ICT innovations by university students were available. So did studies (e.g. Bakkabulindi, Mulumba, Aluonzi, Oketch & Taibu, 2010) that did not support the hypothesis. Thus to clarify the truth, in this study a leaf was tentatively borrowed from Rogers who asserts that the earlier users of innovations tend to have higher incomes than the late users. Hence the hypothesis:

H6:   Income level was positively related to the use of the Internet.

4   Methods

4.1   *Population and Sample:* The target population in the study was constituted by all doctoral students in the School of Postgraduate Studies and Research (SPSR), Kampala International University (KIU), in a recent academic year. However because of constraints, the accessible or sampled population was constituted by only those doctoral students in their first and second years who were still doing their coursework papers, on account of relative ease of access to them, compared to those who had dispersed to their respective home districts in Uganda and other countries, to concentrate on research. The sampled population numbered 50, to whom questionnaires were directed, of whom 45 responded, giving an overall response rate of 90%.

4.2   *Data Collection Instrument:* Data were collected using a self-administered questionnaire, SAQ with three background items of relevance in the study, namely the organization a respondent worked for; their jobs; and areas of specialization in their PhD studies. Then the instrument had eight items (adapted from Bakkabulindi, 2012, where they recorded $\alpha = 0.89$) on the dependent variable (DV), namely the use of the Internet, with each of the eight items scaled on a five-point Likert. It had five items (adapted from Bakkabulindi & Ssempebwa, 2011, where they recorded $\alpha = 0.66$) on the first independent variable (IV1) on the extent to which a respondent had interacted with ICT change agents at different levels

of life, with each scaled using the five-point Likert scale. It equally had three items (adapted from Bakkabulindi & Ssempebwa, 2011, where they recorded α = 0.61) on the second IV (IV2) on the extent to which a respondent had received ICT training at different education levels. It had five items (adapted from Bakkabulindi & Ssempebwa, 2011, where they recorded α = 0.66) on the third IV (IV3) on the cosmopolitanism of a respondent, each of which was scaled on a four-point Likert. The SAQ had an item on the fourth through sixth IV (IV4 through IV6) on the age, gender and income level of a respondent.

4.3   *Data Management:* The data on returned questionnaires were edited, coded and entered into the computer using the Statistical Package for Social Sciences (SPSS). Relative frequencies and means were used for descriptive data analysis. Validity and reliability of data on multi-item constructs were ascertained using Factor Analysis and Cronbach Alpha respectively. Regression Analysis helped with the test of all the hypotheses at the multivariate level.

5   Results

5.1   *Descriptive Analysis: The Profile of Respondents:* Table 1 illustrates that the typical respondent was an employee of Kampala International University, KIU (80%); doing the job of as a teacher (over 55%); specialising in either Education Management (over 33%) or Public Management (over 33%). The typical respondent was aged between 30 and 40 years (almost 40%); a male (81%); and perceived him/ herself as being of medium income (over 76%).

Table 1   Demographic profile of respondents

Description	Category	Frequency *	Percentage
Organisation of employment	Kampala International University (KIU)	32	80.0
	Other university than KIU	4	10.0
	Education institution but not university	2	5.0
	Other organisation than educational	2	5.0
Job	Teaching	21	55.3
	Management/ Administration	9	23.7
	Both	8	21.1
Area of specialisation at PhD	Business Management	8	20.5
	Education Management	13	33.3
	Management Information Systems	5	12.8
	Public Management	13	33.3
Age group in years	Below 30	14	36.8
	30 but below 40	15	39.5
	40 and above	9	23.7
Gender	Female	8	19.0
	Male	34	81.0
Income level	Low	8	19.0
	Medium	32	76.2
	High	2	4.8

*Item total frequencies differ because of non-responses

5.2   *Descriptive Analysis of the Dependent Variable: The Use of the Internet:* The use of the Internet (UI), the dependent variable (DV) in the study was a multi-dimensional variable

made of eight items, each scaled 1 = Very rarely or never, including never heard of it; 2 = Rarely; 3 = Fairly, that is neither rarely nor regularly; 4 = Regularly; and 5 = Very regularly. Table 2 presents the study items for the DV, their means, factor loadings and Cronbach alphas. Except for items UI1 (Email) and UI2 (Web surfing) which attained at least good ratings of use, the means on all other items in Table 2 were at most "3" which on the rating scale used corresponded to "neither rare nor regular". Hence overall, the respondents recorded poor levels of the use of the Internet facilities. To establish construct validity, Factor Analysis was used to extract two factors from the eight items on the DV, with the first having an eigenvalue of 4.32 against 1.56 for the second factor. The first factor explained almost 54% of the variance in the construct while the second explained almost 20% of the variance.

Considering the factor loadings with absolute values above 0.5 as being high (Pituch & Lee, 2006, p. 232), it is apparent that while the first factor loaded highly on all items of the use of the Internet (UI) except the first two, the second factor highly loaded on only the first two items (UI1 and UI2). Such items (UI1 and UI2) not loading highly on the first factor were dropped from analysis. Thus only the remaining items (UI3 through UI8) were considered valid. Having dropped the invalid items, Cronbach alpha originally 0.8666, which was high since it exceeded 0.7 (Hair, Anderson, Tatham & Black, 2006), was recomputed to yield 0.8955, meaning that dropping the items not only made the measure more valid, but also more reliable. An overall average index "UI" on the six valid items on the "use of the Internet", had a mean of 2.27, which was about "2" which on the rating scale used, corresponded to "rare", and hence poor levels of use. In other words, the respondents rated themselves as "poor" on the use of the Internet.

Table 2 Means, validity and reliability analyses on use of Internet facilities

Item	Description	Mean	Factor [+]		Cronbach, α
			(1)	*(2)*	
UI1*	Electronic mail	4.55		0.829	0.8666 **
UI2*	Web surfing	4.20		0.878	0.8955 ***
UI3	Bulletin board services	2.33	0.742		
UI4	Computer conferencing	1.83	0.842		
UI5	Video conferencing	1.76	0.891		
UI6	Electronic journals	2.78	0.734		
UI7	Electronic databases	2.20	0.920		
UI8	Online library catalogs	2.55	0.812		
Eigenvalue			4.32	1.56	
% variance			53.94	19.85	

[+]   Only factor loadings with absolute values above 0.5 reflected (as per Pituch & Lee, 2006, p. 232).
*   Dropped from analysis due to low load on the main factor
**   Before dropping items
***   After dropping items

5.3   *Descriptive Analysis of the Independent Variables:* The first independent variable (IV1) in the study was a respondent's level of interaction with ICT change agents. "Interaction with ICT change agents" (CA) was operationalised using five items each scaled using the five-point Likert scale, as ranging from the worst case scenario of a minimum of 1 = Very little or not at all, through 2 = Little, 3 = Neither little nor urban, 4 = Much to a maximum of 5 = Very much. Table 3 presents the study items for IV1 (CA), their means, factor loadings and Cronbach alphas. The means (in Table 3) suggested that CA tended to

rise with the education level from "low" levels for home, primary and secondary schooling levels, to "fair" levels for tertiary level and "good" levels for the current place of work. To establish construct validity, Factor Analysis was used to extract two factors from the five items on IV1, with the first having an eigenvalue of 2.04 against 1.63 for the second. The first factor explained almost 41% of the variance in the construct while the second explained almost 33% of the same.

Considering the factor loadings with absolute values above 0.5 as being high (Pituch & Lee, 2006, p. 232), it is apparent that while the first factor loaded highly on the first three items of CA, the second factor highly loaded only on the fourth and fifth items (CA4 and CA5). Items CA4 and CA5 not loading highly on the main factor were dropped from analysis. Thus the other three items (CA1, CA2 and CA3) were considered as valid. Having dropped CA4 and CA5, Cronbach alpha originally 0.5482, which was low since it was below 0.7 (Hair et al., 2006), was recomputed to yield 0.7142, which meant that dropping the fourth and fifth items (CA4 and CA5) not only made the measure more valid, but also more reliable. An overall average index "CA" on the three valid items, had a mean of 1.58, which was about "2" which on the rating scale used, corresponded to "little" interaction with ICT change agents.

Table 3 Means, validity and reliability analyses on interaction with ICT change agents

Item	Description	Mean	Factor [+]		Cronbach, α
	Interaction with ICT change agents at….		(1)	(2)	
CA1	Home before schooling	1.59	0.604		0.5482 **
CA2	Primary school level	1.37	0.914		0.7142 ***
CA3	Secondary school level	1.78	0.865		
CA4*	Tertiary school level	3.47		0.829	
CA5*	Place of work	4.37		0.872	
Eigenvalue			2.04	1.63	
% variance			40.77	32.59	

[+] Only factor loadings with absolute values above 0.5 reflected (as per Pituch & Lee, 2006, p. 232).
* Dropped from analysis for low load on main factor
** Before dropping the items
*** After dropping the items

The second IV (IV2) in the study was the amount of ICT training (T) that a given respondent had received. "ICT training" (T) was in turn operationalised using three items each scaled using the five-point Likert scale, as ranging from the worst case scenario of a minimum of 1 = Very little or not at all, through 2 = Little, 3 = Neither little nor urban, 4 = Much to a maximum of 5 = Very much. Table 4 presents the study items for IV2 (T), their means, factor loadings and Cronbach alphas. The means (in Table 4) suggested that levels of ICT training (T) tended to rise with the education level from "very little or not at all" during primary schooling (T1) to "little" for secondary schooling (T2) and "much" for tertiary school (T3). To establish construct validity, Factor Analysis was used to extract one factor from the three items on IV2, with an eigenvalue of 1.83. The factor explained over 61% of the variance in the construct.

Considering the factor loadings with absolute values above 0.5 as being high (Pituch & Lee, 2006, p. 232), it is apparent that the factor loaded highly on only the first two items of ICT training (T1 and T2). Thus only these two items on T were considered as valid. The corresponding Cronbach alpha of magnitude 0.5651, which was low since it fell short of 0.7

(Hair et al., 2006), was recomputed to yield 0.8474, which was high since it exceeded 0.7 (Hair et al., 2006), meaning that dropping the third item, not only made the previously invalid measure to be valid, but also more reliable. An overall average index "T" on the two valid items on "ICT training", had a mean of 1.45, which was about "1" which on the rating scale used, corresponded to "very low" levels of ICT training.

Table 4 Means, validity and reliability analyses on ICT training

Item	ICT training....	Mean	Factor +	Cronbach, α
T1	Primary school level	1.26	0.91	0.5651**
T2	Secondary school level	1.64	0.93	0.8474***
T3*	Tertiary school level	3.51		
Eigenvalue			1.83	
% variance			61.14	

+ Only factor loadings with absolute values above 0.5 reflected (as per Pituch & Lee, 2006, p. 232).
* Dropped from analysis for low load on the factor
** Before dropping the item
*** After dropping the item

The third IV (IV3) in the study was cosmopolitanism of a respondent. Operationalising cosmopolitanism (C) as ranging from the worst case scenario of "rural poor" to the best case scenario of "urban elite", the respondents were asked to do self-rating as to the places where they had resided at five different levels in life, using a scale ranging from a minimum of 1 = rural poor, through 2 = rural but elite, 3 = urban poor, to a maximum of 4 = urban elite. Table 5 presents the study items for IV3 (C), their means, factor loadings and Cronbach alphas. The means (in Table 5) suggested that levels of cosmopolitanism tended to rise with the education level from "rural but elite" for places of both childhood (C1) and primary schooling (C2) to improving levels of "urban poor" for both O-level schooling (C3) and A-level schooling (C4) and "urban elite" for current place of abode (C5). To establish construct validity, Factor Analysis was used to extract two factors from the five items on IV3, with the first having an eigenvalue of 2.74 against 1.26 for the second. The first factor explained almost 55% of the variance in the construct while the second explained slightly over 25% of the same.

Considering the factor loadings with absolute values above 0.5 as being high (Pituch & Lee, 2006, p. 232), it is apparent that while the first factor loaded highly on the first four items of cosmopolitanism (C), the second factor highly loaded only on the first two (C1 and C2) and the fifth item (C5). Items C1 and C2 loading highly on more than one factor were dropped from analysis, due to complexity (Wang, Wang & Shee, 2007), while item C5 was dropped from analysis, due to its low load on the main factor. Thus the remaining two items (C3 and C4) were considered as valid measures of C. Having dropped C1, C2 and C5, Cronbach alpha originally 0.7878, which was high since it exceeded 0.7 (Hair et al., 2006), was recomputed yielding 0.8915, meaning that dropping the items not only made the measure more valid, but also more reliable. An overall average index "C" on the valid two items on "cosmopolitanism", had a mean of 3.02, which was about "3" which on the rating scale used, corresponded to "urban poor".

Table 5 Means, validity and reliability analyses on cosmopolitanism

Item	Description	Mean	Factor +		Cronbach, α
	Place of residence during (most of)....		(1)	(2)	
C1*	Childhood before	2.34	0.768	-0.548	0.7878**

Code	Description	Mean			
	schooling				
C2*	Primary schooling	2.38	0.789	-0.515	0.8915***
C3	O level secondary schooling	2.98	0.890		
C4	A level secondary schooling	3.10	0.748		
C5****	Place of current abode	3.64		0.673	
Eigenvalue			2.74	1.26	
% variance			54.79	25.10	

[+]   Only factor loadings with absolute values above 0.5 reflected (as per Pituch & Lee, 2006, p. 232).
*   Dropped from analysis due to complexity
**   Before dropping the items
***   After dropping the items
****   Dropped from analysis due to low load on the main factor

The fourth IV (IV4) in the study was the age of a respondent. The respondents were thus prompted to state their ages to the nearest whole year, yielding a mean and median of 35.2 and 32.0 years respectively. The ages had a range of 39 years that is from a minimum of 27 to a maximum of 66 years. Otherwise, as per Table 1, those aged "30 but below 40" were almost 40%, followed by those "below 30" (almost 37%) and trailed by those aged "40 and above" (24%). The fifth IV (IV5) was the gender of a respondent, categorized as female and male. And according to Table 1, the males (81%) greatly outnumbered the females (19%) among the respondents. The sixth IV (IV6) in the study was that income level of a respondent, where the respondents were asked to rate themselves using a scale where 1 = Low; 2 = Medium; and 3 = High. Table 1 already illustrated that the majority (over 76%) described themselves as of medium income, followed by those who categorized themselves as of low income (19%) and trailed by those of high income (less than 5%).

5.4 Inferential Analysis: Multivariate Analyses for Testing the Hypotheses: To establish which of the IVs were significant correlates of the use of the Internet (the DV), a multivariate tool, namely multiple regression analysis was used. But before fitting the multiple regression model, the IVs were treated as follows: Being continuous variables, "interaction with ICT change agents" (CA in Table 3), ICT training (T in Table 4), cosmopolitanism (from Table 5) and age were used in the model with no modification. However, dummies were created for the gender (0 = female; 1 = male) and the income level (0 = Low; 1 = Medium and high). Table 6 gives the multiple regression analysis of the DV (the use of the Internet, UI) on the IVs, namely the six personal characteristics. Analysis of Variance (F = 2.644) suggested that the model relating the DV and the six IVs was good at the five percent level of significance (p = 0.05), and the adjusted R square ($R^2 = 0.291$) indicated that over 29% of the variation in the DV could be attributed to those six IVs. However, the t values suggested that of the six IVs, only age (Beta, β = - 0.575) was a significant negative correlate ($\beta < 0$) of the DV at the one percent level of significance ($|t| > 2.58$). In other words, multivariate regression analysis led to the rejection of all the six research hypotheses, save the fourth one (H4).

Table 6   Regression of use of Internet on individual adopter characteristics

Individual adopter characteristic	β	t
Interaction with ICT change agents	- 0.017	-0.056
ICT training	0.220	-0.600
Cosmopolitanism	0.217	1.138
Age of respondent (yrs)	-0.575	-2.919
Gender dummy (0 = female; 1 = male)	0.270	1.447

Income level dummy (0 = Low; 1 = Medium and High)	0.382	1.394

F = 2.644 (p = 0.051);   Adjusted R square = 0.291

6   Discussion

The study did not support the first research hypothesis (H1) to the effect that interaction with ICT change agents was positively related to the use of the Internet. This finding was not only inconsistent with many other studies (e.g. El-Gayar et al., 2011), it was also at odds with theoretical assertions such as that by Stuart et al. (2009) to the effect that a potential adopter who has more contacts with a relevant change agent is more likely to use the pertinent innovation than those with fewer contacts. The possible explanation for the unexpected finding could still be found in Stuart et al. who observe that the mere presence of champions is inadequate unless the champions "communicate a clear vision of an innovation, display enthusiasm for the innovation, demonstrate commitment and involve others in supporting it"; unless they exude "confidence, persistence, energy and risk-taking" (p. 734). May be the ICT champions in Kampala International University (KIU) lack these attributes. If that be the case, then the finding leads to one major conclusion, namely that the ICT change agents in KIU such as the University's Directorate of ICT Support should try to communicate a clear vision of the Internet, display enthusiasm for it, demonstrate commitment and involve others in supporting it. They should endeavour to exude "confidence, persistence, energy and risk-taking" (Stuart et al., 2009) with regard to the Internet.

The study rejected the second research hypothesis (H2) to the effect that ICT training positively correlated with the use of the Internet. This finding was at variance with many other studies (e.g. Gakibayo et al., 2013; Khan et al., 2011; Okello-Obura & Ikoja-Odongo, 2010). It was also at odds with theoretical assertions such as those by Ng'ethe et al. (2012) and Sinha and Sinha (2012) who argue that adaptability to technological advances is a factor of training. This anomalous finding could be as a result of not probing deep enough to know which kind of ICT qualifications the doctoral students in KIU held. May be they held too low ICT qualifications to enhance the use of the Internet as expected. In the mean time, the study laid enough ground for the conclusion that relevant stakeholders such as the University's Top Management and the Directorate of ICT Support should give all its doctoral students equal exposure and/ or encouragement with respect to Internet, irrespective of their differentials in ICT qualifications.

The third hypothesis (H3) was that there was a significant positive correlation between cosmopolitanism and the use of the Internet, but it was not supported by the study. The finding was at variance with other studies (e.g. Amutabi & Oketch, 2003). The explanation for the anomalous finding could be that while innovations are expected to start from urban or cosmopolitism areas and spread to other areas (Bisaso & Visscher, 2005) both rural and urban areas in Uganda have equally low levels of use of the Internet to the extent that the urban or cosmopolitan ones do not enjoy any advantage. The study finding might be implying that all the doctoral students in the University, whether from a cosmopolitan or rural background should be given equal exposure and/ or encouragement by the change agents such as the Directorate of ICT Support with respect to the Internet.

The study did uphold the fourth hypothesis (H4) to the effect that age was inversely related to the use of the Internet. The study finding was consistent with several past studies (e.g. Bakkabulindi & Kabasiita, 2012) and concurred with theoreticians such as Kok et al. (2011) who observe that age is an important negative correlate of the use of innovations. In

conclusion, it is being recommended that the stakeholders in KIU such as the Top Management and the Directorate of ICT Support give preferential encouragement with respect to the Internet, to the aged and ageing doctoral students. The fifth hypothesis (H5) was that gender related with the use of the Internet, with the males being more frequent users. However the study did not support it, a finding which was also contrary to findings of other studies (e.g. ECAR, 2010; Huang et al., 2013; Sim et al., 2011). The possible explanation for the study finding is that as the Internet is becoming more ubiquitous, it is no longer a male domain (Sang et al., 2010). The study finding thus could be a reasonable basis to suggest that both male and female doctoral students in KIU needed equal exposure and/ or encouragement with respect to Internet resources, and hence the call to the Directorate of ICT Support to afford them the same.

The sixth hypothesis (H6) in the study, namely that the income level positively related with the use of the Internet, was not upheld. This was inconsistent with the findings of several other studies (e.g. Bakkabulindi et al., 2009), and challenged the theoretical assertion that the higher the income, the easier it is for an individual to acquire, or otherwise access, expensive innovations (Rogers, 2003) such as the Internet. The possible explanation for this unexpected finding could be that the doctoral students with more financial ability to access the Internet tended to be older, making their advanced age to militate against their eagerness to go in for the innovation (the Internet) (Schiffman & Kanuk, 2004). The opposite may have been true for the less financially able doctoral students. This inconclusive debate raises a gap for future researchers to consider. In the interim however, the study finding seems to imply that the Directorate of ICT Support and other relevant ICT change agents in the University should give all the doctoral students equal exposure and/ or encouragement with respect to Internet facilities, regardless of their income levels.

7. Conclusion and Recommendations

The Internet represents an extremely efficient medium for accessing, organizing and communicating information. Compared with other means of communication such as the post, telephone and fax, the Internet provides a flexible, reliable and low-cost method for communication. Specifically, regarding the utility of the Internet in Education, institutions of higher learning can benefit greatly from the Internet in several areas including literature search, communication and entertainment. This study examined the use of the Internet by doctoral students in Kampala International University (KIU), and related this use with the personal characteristics of individual students, namely their levels of interaction with ICT change agents, ICT training, cosmopolitanism, age, gender and income level. The study found insignificant relationships between the use of the Internet, and all the independent variables except for age which was found to be a significant negative correlate of the dependent variable (the use of the Internet). These findings have practical significance to the ICT change agents in the University, in that they imply that the older doctoral students deserved preferential treatment in terms of encouragement and exposure, with respect to the use of the Internet.

Despite the contribution, the study had limitations. For example it used only individual adopter characteristics as independent variables, yet there were also perceived ICT characteristics and organisational characteristics (e.g. see Rogers, 2003). Future studies should integrate more of these independent variables. Also the data were based on self-reporting, which implies that participants may have provided less-than-accurate responses,

although use of anonymous questionnaires may have reduced likelihood of this bias. The cross-sectional nature of the study restricts full understanding of the decision making process with regard to the use of the Internet. It is thus recommended that future researchers replicate the study longitudinally to identify the dynamics among factors critical to the decision use the Internet. However the study contributed to the ongoing debate on factors related to the use of the Internet.

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LEARNERS' PROFILES WHEN EXPERIENCING TECHNOLOGY-BASED LEARNING IN THE FOUNDATION PHASE

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Abstract
The role of technology in learning has great importance today as the world is being transformed by digital technologies at an expeditious rate. With this in mind it was increasingly important to question how these changes have influenced Foundation Phase learners and especially their experiences of Technology-based Learning (TbL). Qualitative case study research methods such as photo voice, narratives and field notes were conducted with 10 grade 3 learners at two technology-rich schools in Gauteng and examined through a conceptual framework which included the TPACK framework, generation theory and the learning theory of *inter alia* connectivism. Data was interpreted according to the main elements of the theoretical framework, namely *technology*, *pedagogy* and *content* in relation to the research themes of *technological tools*, *21st century skills* and *TbL.* Finally, the significance of this study was that the data gathered proved worthwhile in understanding Foundation Phase learners in context which accounts for inferences to be made from the phenomenon of TbL to all stakeholders involved in Foundation Phase education.

Keywords: Technology-based learning (TbL), Digital literacy, Foundation Phase learners, generation theory, Technological Pedagogical and Content Knowledge (TPACK)

Introduction
Technology in this age is ubiquitous and is changing the way that individuals live, work and play. In line with this, South African education has to change regularly to meet the requirements set out by the Department of Education, including the development of learning outcomes for the 21st century which recognise learners to use information in particular contexts (Department of Education [DOE], 2001; Law & Chow, 2008b in Leendertz, Blignaut, Niewoudt, Els & Ellis, 2013, p1). According to Maaga (2009, p1), the early childhood phase of birth to nine years of age is the most crucial phase for every human being. The Foundation Phase of formal education incorporates these years and ensures that quality early learning provides children with the best possible start in life. A firm learning foundation in the Foundation Phase presupposes attention to, as well as understanding of cohort in which the new young learners find themselves.

Furthermore, Weiler (2004, p46) suggests that, "it may be that academe, and indeed the entire world, is currently in the middle of a massive and wide-ranging shift in the way knowledge is disseminated and learned." Prensky (2001) states that neurobiology and social psychology have proved that various kinds of technological stimulation actually alter brain structures and affect the way people think. More recently, the same author stated that "technology, rather, is an extension of our brains; it's a new way of thinking. It's the solution we humans have created to deal with our difficult new context of variability, uncertainty, complexity, and ambiguity" (Prensky, 2013, p22). In line with Prensky, the generation theory (Strauss & Howe, 1991; 1997) explains how the era in which a person is born affects their view of the world and predicts behaviour and expectations. Since the children of today are being

socialised in a vastly different way, this study provides valuable insight regarding the manner in which the present day generation of Foundation Phase learners learn from a South African educational research perspective

This study explored the use of technology as a tool for learning in the Foundation Phase through learners' experiences thereof, specifically the aspects that influenced young children's learning. The paper was guided by the following main research question:

- What are learners' experiences of technology-based learning in the Foundation Phase? The investigation into the phenomenon of TbL in the Foundation phase was further supported by the subsequent secondary research question:

- What is the 'technological profile' of Foundation Phase learners?

Conceptual Framework
The conceptual framework of this study comprised of learning theories that are applicable to TbL, the generation theory and TPACK framework which are briefly discussed below.

Learning theories
Researchers and educational psychologists have proposed a number of learning theories over the past century in order to explain individuals' acquisition of knowledge (Shulman & Quinlan, 1996). Theories have been classified according to different paradigms with the main ones used in education being classified as cognitivist, behaviourist, constructivist, humanist or descriptive metatheories (Pound, 2011). For the purpose of this study, only learning theories that are founded in a constructivist and behaviourist paradigm as well as connectivism will be discussed, due to their relevance to the digital era. Behaviourism has been used to describe complex learning circumstances and is grounded in the central idea that a response occurs from a certain stimulus (Pritchard, 2008). From a constructivist stance (Piaget, 1952) believed that learning comes from the child alone with knowledge being constructed through their interaction with the environment. Vygotsky (1999), elaborated on Piaget's work by stating that children construct knowledge in a challenging environment with the help of a more skilled adult or peer. However, Siemens (2005) argued that connectivism is the more contemporary and more suitable learning theory since the pace of change is so rapid in today's world that extended expertise requires continuous learning (and unlearning) of the vast amounts of knowledge over a lifetime which can no longer be contained within the mind of a single individual, and instead is now better stored and processed through technology.

Weegar and Pacis (2012) advocate that blending the two theories, behaviourism and constructivism since they can be used in combination with educational technologies seems to be a preferred approach to TbL. Additionally teaching and learning needs to be transformative and trans-disciplinary in the 21st century and to this end, connectivism is especially conducive in understanding the use of digital technology for learning (Mishra, Koehler & Henrikson, 2011).

Generation theory
Archaic societies, philosophers and even the Hebrew Bible point towards the generations to explain how and why recurring archetypes occur (Strauss & Howe, 1997, p. 14-15). "A generation, in turn, is the aggregate of all people born over roughly the span of a phase of life who share a common location in history and, hence, a common collective persona" (Strauss

& Howe, 1997, p. 16). Codrington and Grant-Marshall (2011, p. 12) defined a generation as "a group of people with a set of shared experiences that exhibit a shared worldview, and continue to exhibit the characteristics of that worldview until they grow up through life." Furthermore, these authors explained that it has become significant to use the notion of generation identity to understand each new generation since time and events are quickening.

Strauss and Howe (1991) explained a generation cycle by consecutive 20 year cohorts, in a four stage process of history spanning roughly 80 years. The generation archetypes were since renamed in The Fourth Turning (Strauss & Howe, 1997), where Idealist became Prophet, Reactive became Nomad, Civic became Hero and Adaptive became Artist. The importance of the above mentioned is to highlight the nature of the generation theory, as well as its inevitable application to this study in terms of classifying current learners as Artist archetypes and explain the reason for the similarities and differences between the generations involved in teaching and learning in the Foundation Phase.

TPACK framework
Shulman (1986) introduced the notion of pedagogical content knowledge (PCK) which went beyond knowledge of subject matter only and included knowledge about how particular content can be taught. Within the context of a technological environment, Koehler and Mishra (2005) recreated Shulman's idea of PCK to represent the concept of technological pedagogical and content knowledge (TPACK). Hence, there are three primary constituents for learning with technology - content, pedagogy and technology - and the interaction between these bodies of knowledge are essential to the framework (Koehler & Mishra, 2009). At the centre of the framework is the interaction of all three bodies of knowledge known as technological pedagogical content and knowledge. TPACK essentially consist of seven knowledge areas, which are outlined in the Figure 1. For the purpose of this study and in line with Agyei and Keengwe, (2014) it is essential to pay attention to the specific context in of TbL particularly when using TPACK.
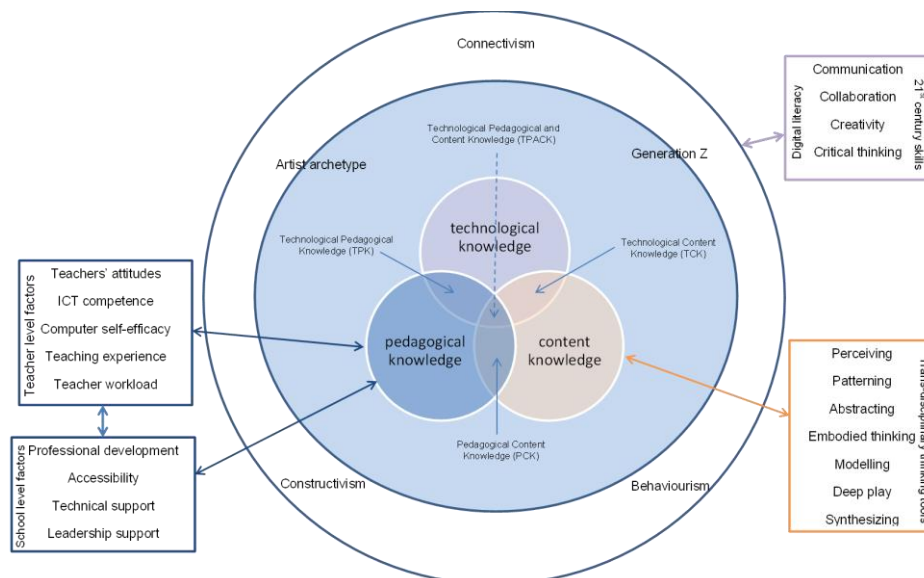

Figure 1:   Conceptual framework

To understand the context of learners currently in Foundation Phase, the conceptual framework above was used since these principles, in theory and practice, produced "flexible

knowledge" that was needed to investigate TbL in the Foundation Phase (Koehler & Mishra, 2009, p. 60; Koehler, Mishra & Cain, 2013, p 13). For the purpose of this paper, only aspects pertaining to TbL, and which minimize teaching, are important.

Methods
Research design
Data were collected at two technology-rich research sites. This study sought to understand the Grade 3 learners' learning environment since "the social world consists of and is constructed through meanings" (Livesey, 2006, p. 4). The prime motivation was to take a social view by examining learners' everyday interactions in their natural environment of their classroom. Furthermore, Nieuwenhuis (2007) explained that within the interpretivist paradigm, human behaviour is affected by knowledge of the social world, which emphasises a two-way relationship between theory and research. Regarding the methodology of the study, the theoretical was linked to the empirical by means of a qualitative case approach to conduct and interpret a multifaceted study. The use of TbL was explored based on the assumption that it will be useful to know the distinguishing features of this cohort.

Ethical considerations
In line with the ethical regulations of the institution overseeing this study, the participants and their parents were asked for their informed assent and consent respectively which guaranteed safety in participation as well as no risk or harm of any kind. Participation was voluntary and participants were able to withdraw from the study at any time. Approval from an ethics committee was granted before this study commenced.

Trustworthiness
In relation to this study, trustworthiness was addressed through a "…constant search for convergence among multiple and different sources of information…" (Nieuwenhuis, 2007, p81) which accompanied the researcher's attempt to remain impartial and enhance the trustworthiness of the data by establishing the truth through the use of numerous data collection processes. Furthermore, the data gathering process was triangulated by obtaining photographs, narratives and field notes.

Data collection
Qualitative research uses a naturalistic approach that seeks to understand phenomena in context-specific settings, such as Grade 3 learners in South African schools, which presents a "real world setting [where] the researcher does not attempt to manipulate the phenomenon of interest" (Patton, 2001, p. 39). Several types of information such as photo voice, narratives and field notes were collected in order to answer the question and establish the complexity of TbL. The three phases of data collection are delineated below:

Table 1:   Phases for data collection

PROJECTION OF DATA COLLECTION			
PHASE	**DATA COLLECTION STRATEGY**		**OBJECTIVE**
PHASE1	Administration	1.1 Ethical clearance	• Permission to conduct research
		1.2 Contact participants	• Establish relationship with schools

	1.3. Correspondence with participants and parents	• Explain nature and intent of study	
PHASE 2 *Facilitate Photo Voice*	*2.1 Photo Voice Technique*	1. Orientation	*2.3 Field notes*
	• Discussions • Preliminary field notes	2. Exhibition	
	2.2 *Narratives* (learners)	3. Wrap-up	
PHASE 3	Analysis	• Gather data • Interpret data	

During the photo voice approach participants are given disposable cameras and are prompted to take pictures of anything that is related to the subject at hand. The particular strengths of the photo voice method (also known as "reflexive photography") are to emphasize personal experiences in particular, as well as to gain maximum commitment in participants' contribution in the research project (Olivier, Wood & De Lange, 2009). This technique was chosen particularly to insure the young learners' involvement. With regard to the scepticism of involving young children in this technique, Strack, Magill and McDonagh (2004) noted that similar "to Freire's (1973) line drawings which served to personalize issues for discussion, the youth's own photos created a great sense of pride and ownership that contributed to their exchange of views." As organised by Olivier, Wood and De Lange (2009), the researcher implemented a step-by-step guide to facilitating a photo voice project which consisted of three sessions (Orientation, Exhibition and Wrap-up) as follows:

• Session 1: Orientation
Ten Grade 3 learners were purposively selected in a homogenous sample and requested to participate in the project. The participants were issued with the following prompt for taking the pictures: *How do you learn?* The participants were given three days to take photographs, with a free hand, of anything that they identified with the subject at hand. The films were developed and the photographs printed.

• Session 2: Exhibition
During the second session the participants displayed their pictures individually in a classroom. Each participant was asked to pick one picture that was most representative of their experience of learning. They were requested to write a narrative of about half a page on the selected picture and to submit these within one week.
• Session 3: Wrap-up
The third session involved meeting with the participants where they were given the chance to present their written narratives. This point in data collection was valuable since it was necessary to understand the young learners' experience through their beginner writing. The pictures and narratives were subsequently analysed and interpreted.

Sample
Participants' names were not disclosed so as to protect their anonymity and confidentiality. The photographs and narratives offered data that was both interesting and of great value in

eliciting responses to learners' experiences of TbL in the Foundation Phase. Finally, significant points that were extracted from the individual narratives were also discoursed.

Results

The data that was collected by means of photographs, narratives and field notes provided insight into the descriptions and understanding of TbL in the Foundation Phase from each participant. The researcher detailed points of view that were extracted from the learners' responses. Since the research sites were two technology-rich schools, themes overlapped in accordance with the technological trends of the time. Additionally, it was evident that the data produced had strong links to the theory behind this research. It was particularly useful to use the elements from the conceptual framework of this study to code and organise the data. The exposed data was illuminating and provided detailed information that contributed to the themes of this research, namely: technological tools; 21st century skills and TbL itself. A deductive analysis of the data which was based on literature and the conceptual framework with the elements of technology, pedagogy and content were all noteworthy to consolidate theory with empirical data.
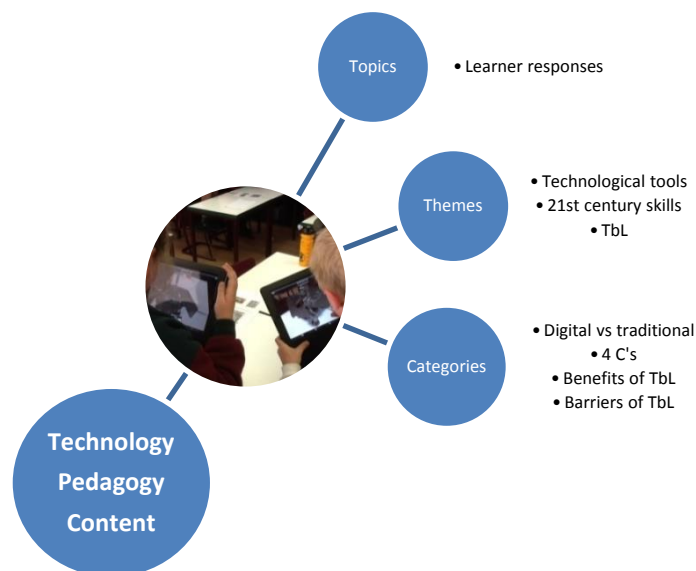

Figure 2:   Findings according to data analysed

Discussion

All Foundation Phase classrooms need to be technologically supported.

This study focussed on two schools that were technology-rich for the reason that the infrastructure and the use of technological tools with the necessary support were established Unfortunately, literature revealed that this is not the case in all South African schools as Meier (2013) cites that the directive for the provision for Early Childhood Development in South Africa, is competent to meet international standards in policy but under closer scrutiny, this picture is thwarted. Furthermore, advancement in TbL is determined by sound infrastructure in the country as a whole (Department of Basic Education, 2015). This cohort of learners rely on visual sources of information, by using the array of technological tools that participants referred to, which is an effective means of information gathering to suit a particular and personal learning style (Weiler, 2004). Both literature and data discovered that infrastructure to take advantage of technology-based learning is advantageous to meeting individual learning styles.

Guidelines for the technological pedagogy need to be developed.
The TPACK framework proves that technology can benefit pedagogy when used correctly. Participants cited subjective strategies and techniques when it comes to technology-based learning. It is accepted that young children differ from previous generations and therefore, so should the way in which they are taught be distinct. Although young children have a specific learning style and therefore a specific child-centric, play-based curriculum is necessary, technology can provide support in a plan that is available and adaptable beyond the classroom. Data highlighted this possibility of 'anywhere-anytime' teaching and learning a numerous times in comments such as:

> *We've got our iPads, mini iPads, so if we need to learn outside wherever, if we go on a field trip and we need to take photographs or if they need to answer questions, things like that, they can record it, it's portable.*
> *You can contact people overseas and your friends easily. We send emails and our projects to children from another school.*

New knowledge and skills are needed to meet the demands of living in the 21st century and therefore, novel ways of learning is required from our teachers and learners. In light of the above mentioned, the Action Plan to 2019 (DBE, 2015: 18) stresses the priority for dependably designed interventions from the government to contend with the digital divide in South Africa by taking charge of technology betterment. An important document but not entirely sufficient to the Foundation Phase was the dispensation of the Green Paper on ICTs (Department of Communication, 2014). However, this policy framework does not service the Foundation Phase and moreover, does not explicate the pedagogical aspect of teaching and subsequent learning with technology.

Teachers and learners need support in finding appropriate content.
Participants' responses highlighted that in one way or another, learners are involved in research. This research ranges from finding out simple information on the internet to looking for suitable content during lessons in responses such as:

> *I use google mainly to find out stuff, like for school projects…If you don't use it you don't know what's going on.*

In line with the TPACK framework of this study, technological knowledge (TK) and content knowledge (CK) are applicable. Nyambane and Nzuki (2014, p. 3) suggest that "the two important elements of teaching and learning which are content and pedagogy must be joined when technology is used." Therefore, in order to provide the appropriate support to choose the actual technology as well as the associated content for the technology, role players need to distinguish that using a certain technology can modify the way that learners grasp concepts in that particular content area. Using technology for learning establishes an environment that is dynamic while at the same time reconstructing learning (Volman & Van Eck, 2001).

This study focused on learners' experiences of technology-based learning in the Foundation Phase. Technological, pedagogical and content factors structured the discussion with the aim of endorsing successful TbL in the Foundation Phase.

Conclusion

Data proved that participants in this study are mostly digitally literate and besides one learner participant who only uses technology at school, the remaining participants all use technology on a daily basis. The views of most of the participants in terms of their digital pedagogies, the willingness to learn and develop 21st century skills alongside emerging technologies was positive. Learners referred to time with technology as being fun with a strong element of play involved.

External, internal and educational reasons accounted for learners' experiences of TbL in the Foundation Phase. External reasons in response to why TbL was used, participants and literature (Bush & Codrington, 2012; Nyambane & Nzuki, 2014; Posnick-Goodwin, 2010; Prensky, 2013) cited reasons such as the impetus to use technology from government and principals; learners use technology as a lifestyle; and children's brains are wired to use technology. Secondly, participants themselves understood the value technology and its influence on their own learning. The internal reasons for the inclusion of TbL in the Foundation Phase were that participants were exploring their own research and development in TbL; recognition that technology improves the performance and capabilities of learners (Kalaš, et al, 2014); and a personal drive to use technology to enhance learning. Lastly, educational reasons were also brought to the fore as Kalaš et al. (2014:28) acknowledges that there is a "range of opportunities being opened up for improving learning with technology." Data revealed educational reasons such as TbL benefitting the development of 21st century skills; the ability to incorporate appropriate content learned in a technologically-rich, Foundation Phase environment; and the understanding to adapt learning approaches to use technology meaningfully.

Additionally, the generation theory was used in order to characterize the cohort of Foundation Phase learners in this study since they are born during a particular period of the same 20 years. Particularly, this theory highlighted that individuals born in a specific era share one of four "peer personalities" (Strauss & Howe, 1991) This generation of learners, Generation Z, has never lived without the Internet and technology which makes the latter an integral component of how they communicate, exchange ideas and acquire knowledge. This study highlighted generation differences which can be attributed to the fact that teachers who are currently teaching generation Z form part of generations Baby Boomers, X and Y. With regard to Generation Z, the Foundation Phase learners in this study, it was evident from empirical data that there is a generation gap between learners and teachers. Participants mentioned that technology is always developing and learning cannot 'stay behind' due to age differences since the learners are using technology successfully from a very young age.

Finally, it was evident that there is a generation gap between teachers and learners, as well as a digital divide between the 'haves and have nots.' Since this is a South African study, it is crucial to mention that the 'technological profile' of the majority of Foundation Phase learners is circumstantial. The Nation's Action Plan 2019 (Department of Basic Education, 2015) posits that without implementing TbL, education is incomplete since technology has the ability to change the way schooling occurs by improving and diversifying learning. As is the case in this study TbL for just a privileged minority can exacerbate future inequalities in South African society through the so-called digital divide.

Literature and empirical data highlighted that the technological profile of Foundation Phase learners is influenced by context (Leendertz et al, 2013; Meier, 2013 and Prensky, 2013). In other words, the participants of this study were situated at technology-rich schools and therefore, their technological knowledge and skills were developed whereas the general population of South African Foundation Phase learners do not have such resources and it can be assumed that their 'technological profiles' are much less developed.

Recommendations

The recommendations from this study are given from a top-down approach. Starting at the proposal that government will have to provide technological support in the Foundation Phase. Thereafter, it is suggested that Foundation Phase teachers will have to change the way they organize teaching to adapt to favourable implementation of TbL. Lastly, it is proposed that Foundation Phase learners should have access to the most appropriate content that is founded and supported by technology. It is therefore recommended that in order for our young children to take advantage of technological tools for learning, that schools are equipped with the necessary infrastructure to do so. Considering the fact that technology has the benefits of adapting classroom practices and being able to teach and learn in exciting, new ways, the effective implementation of the latter still requires support. It is therefore recommended that a set of guidelines for an emergent curriculum, which is based on this generation of learners' interests, is developed to assist teachers and learners to successfully integrate TbL in the Foundation Phase. Additionally, the Green paper on ICT's (DBE, 2014) that will contribute to the body of knowledge on TbL requires further investigation to bridge the gap in the policy surrounding TbL in the Foundation Phase. Lasly, it is important that a collection of appropriate content for various technological tools is developed to meet the demands of TbL in the Foundation Phase.

Closing Remarks

This study has underlined the need for research that will yield practical results to support the effective implementation of technology to enhance learning in the Foundation Phase. It is accepted that young children differ from previous generations and therefore, so should the way in which they are taught be distinct. New knowledge and skills are needed to meet the demands of living in the 21st century and therefore, novel ways of learning are required from our learners. This study was significant in that it provides an educational research perspective of the current generation of Foundation Phase learners' descriptions and experiences of technology-based learning since children of today are being socialised in a vastly different way. Researching TbL in the Foundation Phase has proven that technology is a plausible tool to raise the quality of content and redefine pedagogy when it is understood by role players how to use it beneficially.

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PLANNING STRATEGIES BY TEACHERS FOR TECHNOLOGY EDUCATION IN SOUTH AFRICAN SCHOOLS- HOW FAR ARE WE?

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Abstract
This study contextualized planning as a core curriculum feature by two South African teachers who received some form of informal training but with no formal qualifications in technology. Constructivism as a learning theory augured well in grounding and developing this study. A case study format was adopted which followed a qualitative approach through which teachers' implementations of the intended technology education were investigated. Two purposively selected teachers participated. Structured interviews and observations were the main data collection strategies used. These followed a brief written questionnaire. The questionnaire was explored in terms of an instrument called implementation evaluation rubric. In order for the instrument to serve the intended purpose, three ratings were developed for data analysis. The three ratings were necessary to capture teachers' planning practices within the instrument. The development of the three ratings was derived from a review of literature. Data showed varying levels of planning between the two participants. Findings from the empirical investigations have shown significant differences and similarities. The findings from the operating contexts of the two teachers indicated that the national technology curriculum of South Africa is different from technology education within senior phase.
Keywords: Technology, technology education, capability tasks, constructivism and curriculum.

Introduction

For many years, South Africa has struggled to deliver an acceptable Mathematics, Science and Technology Education (TE) at primary and secondary schools (Gauteng Department of Education, 2010). TE was introduced in the South African basic education system as a pilot project to promote and support social constructivism in public schools in 1998 (De Jager, 2011). At the time, expert practices or the experience in TE teaching to reach the intended educational outcomes were absent (Potgieter, 1999). The majority of South African teachers were not formally educated or trained as technology teachers for a specific phase (Pudi, 2007; Mapotse, 2015a). Some education stakeholders assume that students perform better when their teachers have received quality education and training in the subjects they teach and at the levels/phases in which they are placed (Mapotse, 2015b). Changes in the educational approach from the traditional to the new curriculum required teachers to make adjustments. The adjustments placed specific demands on the teachers especially during planning for lessons (Van Niekerk, Ankiewicz & de Swart, 2006). Planning lessons is a pertinent aspect of teaching as it is central to classroom management (Jacobs, Vakalisa & Gawe, 2004). Planning for technology learning activities requires considerations of outcomes and the content as well as the process used to achieve the outcomes (Killen, 2000).

The specific content which was envisaged for TE brought implications for the teachers who were tasked to teach technology in the classroom. Ozturk (2011:125) remarks that the number

one condition is to make sure that a broad sphere of valuable skills and time are present in planning for the course content, methods, assessment and materials. Talanquer, Novodvorsky and Tomanek (2010:1391) concurs with Ozturk that teachers' planning decisions influence the content, materials, activities, the learning environment and what students learn; instructional activities function as the basic structural units of planning and action in the classroom.

There are various elements of instructional design which teachers need to consider for instruction as they relate to TE. Within these elements planning to teach is expounded. Planning as preparation for teaching occurs at many levels. There is an assertion that lesson planning is executed in the interactive phase where actual presentation takes place (Kruger & Muller, 1998).

South African teachers were sourced from technical TE ranging from woodwork, metalwork, and industrial arts craft disciplines; others were from biblical studies to teach TE. These teachers had to be equipped to make the paradigm shift from their old subjects with their specific planning methodologies, to technology with its specific planning strategies. Therefore varying teacher guidance for planning was essential and of priority in technology classrooms. TE experienced turbulence as a result of the change that was expected from the teachers in relation to planning so as to translate the new curriculum into implementable classroom activities (Lee, 2011).

Given the above discussions, the purpose of this study was to explore and generate an understanding of how teachers, who have not received formal training but received a form of informal training, plan so as to implement the technology curriculum in the General Education and Training band.

Theoretical Framework
In most qualitative studies, theory comes at the beginning and provides a lens that shapes what is looked at and the questions asked especially in a transformative research (Creswell, 2014). A theory in the researcher's thought helps to make research decisions and provide a sense of the world around. Theory is also an explanation that discusses how a phenomenon operates and why it operates as it does (Mapotse, 2015). Constructivism as a learning theory augured well in grounding and developing this study. The development of the Revised National Curriculum Statement (RNCS) rested heavily on beliefs of a constructivist framework (Kotze, 2002). RNCS is the curriculum upon which this study is premised. Current debates around notions of incorporating constructivist learning in technology are progressing. That being the case, Williams (2000:3) outlines the difference in relation to TE is in the theory's usefulness for learners to construct knowledge and solutions towards the completion of tasks. Tasks as referred include capability tasks which are longer, more open ended tasks that require designing, making and evaluation. These are built on learning experiences derived from the case studies and resource tasks (Reddy, Ankiewicz, de Swart, & Gross, 2003). The capability tasks served as cornerstones and building blocks recommended by the Department of Education for the technology curriculum.

According to Killen (2010:6) the basic premise for constructivism is that knowledge is obtained and understanding is expanded through active construction and reconstruction of the mental framework. Two diverse models of a curriculum were developed for constructivism as

cognitive and social constructivism. Cognitive constructivism, according to Killen (2010:6), focuses on the cognitive processes that people use to make sense of the world.

Killen (2000:6) and Kotze (2002:78) agree that social constructivism treats learning as a social process where learners acquire knowledge through interaction with their environment instead of merely relying on teachers. Social constructivism as a theory of learning forms the basis of the rationale of this section of the study where learners are able to solve problems in TE during classroom activities. An example of social constructivism is group work, where they can co-plan, and challenge one another with discussions, which target higher order thinking skills.

The uniqueness nature of the technology subject is that its instruction requires hands-on activities. In presenting technology acknowledges (De Swart, Ankiewicz & Engelbrecht, 2005:28) teachers are required to plan towards the use a variety of instructional approaches and strategies which required learners to become active and self-directed in their learning, which in essence, was a direction towards constructivism. Active learners and self- directed learners are only a possibility after a successful planning by the teacher. In other words, social constructivists envisage teachers who plan towards providing an enabling environment for learners in order to achieve the intended technology curriculum.

Research design and methods
This study adopted a case study format which followed a qualitative approach through which teachers' implementations of the intended technology education was investigated. Convenient sampling was used to select these two teachers. These two teachers teach TE, are at close proximity with the one of us and from two set up of diverse resourced environment. In terms of ensuring for confidentiality, pseudonames were used for the two participating teachers. Two purposively selected teachers participated, namely Thabo from a medium resourced school and Thabang from a highly resourced school in the same district in Pretoria, South Africa. Neither of the teachers had formal education in TE. Their relevance as a sample lies in the opportunities provided that they have to teach the TE. As a result they became a sample accessible to the researcher. In addition, their two contexts were important to achieve a comparative design that would provide the similarities and differences during implementation using the same intended curriculum for the subject.

Structured interviews and observations were the main data collection strategies used. These followed a brief written questionnaire which explored to determine the teachers' implementation practices with specific focus on their planning as a preparation to teach. The questionnaire was explored in terms of an instrument called implementation evaluation rubric. In order for the instrument to serve the intended purpose, three ratings were developed for data analysis. The three ratings were necessary to capture teachers planning practices within the instrument. The development of the three ratings was derived from a review of literature as suggested by (Kotrlik & Redmann, 2009) and (Mentzer & Becker, 2010).

Each rating was a descriptor formulated by the researcher. Three varying ratings were "insufficient", "sufficient" and "sufficiently adequate". Rating 1 "insufficient" was developed by writing descriptors which defined features which related to "planning" for technology curriculum. The word "inadequate" is used interchangeably with "insufficient" within the rubric and discussions. The actual meaning does not alter.

Rating 2 "sufficient" was developed by writing out descriptors which were selected from an "insufficient" rating. The word "moderately" was used to bring emphasis to a summary of a descriptor which defined planning as a feature in the curriculum. While this might be criticised, we did not bring or use words or items which could add another meaning understanding or dimension to the original descriptor. Almond, Winter and Camento (2010:34) stresses that the process is valid as long as no new items are valid this serves as a guide to the conclusion. The word "adequate" will be interchangeably used in the descriptions of the same understandings as with using the word "sufficient".

Rating 3 "adequately sufficient" was developed by writing descriptors drawn from insufficient rating. The word "adequate" is used to bring distinction and concise information for particular information from the insufficient descriptor.

An independent researcher was tasked with supervising the entire process to ensure scientific rigour, credibility and trustworthiness. In addition, interviews and classroom observations were conducted to verify the findings of the questionnaire. The researchers developed the interview questions (items) and observation protocol with guidance taken from literature as well as findings from questionnaires. The set of items which addresses similar themes were coded so as to capture as much detail about a particular theme. The prepared interview schedule and observation protocol was discussed for refinement with work colleagues in the Department of Science and Technology in the school. A senior teacher agreed upon a pilot interview. This was important to ensure content and face validity (Bennet, 2005).

Data analysis

The data analysis of this study, primarily with the nature of the research being qualitative, was reported in a descriptive manner from both the interviews and observations. The data from the interviews and observations were analysed, guided by the rubrics containing ratings. Mouton (2000:108) explains that the aim of analysing data is to determine developing patterns which could be identified and isolated as dominant themes. Using the two methods (interviews and observations) to gather the data was to produce trustworthiness by employing triangulation (Daugherty, 2009). Silverman (2010:277) explained triangulation as understanding a situation by combining different ways of looking at a situation. In addition, the instrument developed by the researcher added to the reliability of the results, and added value for the researcher by look at situations in different ways. Teachers' names, school names and leaner names were removed from the official documents which were included as evidence during data collection. One of us obtained consent from the two teachers for interviews and classroom observations. Consent forms were signed by the two teachers with an understanding of withdrawing from the study at any time. During data discussions, and presentations, as researchers we did not also identify verbatim comments with their names.

Research findings and analysis

This section of the study was led and developed by the following research question: *How do teachers implement the intended national curriculum with technology education as a subject at classroom levels?*

Data showed varying levels of planning between the two participants/teachers/educators. Thabang explained that for him "planning for the following year begins in October and

November". He starts with "macro planning, which involves all the work that has to be covered". He then "breaks the work down into semesters, then weekly planning and daily planning". Thabang uses his daily planning for lesson unit planning. His argument for the kind of planning he undertakes was that it "makes me think on my feet because I already know the type of assessment activities I will give to the learners". Data also revealed that Thabang integrates learning outcomes and assessment into his planning.

In terms of Thabo's planning strategy, it emerged that he is not the only one responsible for planning for his lessons as he shares his work with colleagues. Nevertheless, he indicated that he did "semester planning and not meso planning" which allows him to do adequate "daily planning". Thabo also indicated that his planning is often limited by the resources available at school. As a result, he relies on "recycled materials". This limitation forces him to "use simple approaches as there are more ways of killing a cat". It was however found (during observations) that Thabo does not keep documented plans. Furthermore, he was not able to indicate the learning outcomes of the activity which was presented to learners in class. Thabo was observed a few minutes before the lesson, reading a textbook in preparation for a lesson which was minutes away. During the lesson, learner activities were taken directly from the textbook with no adaptations. Asked about this, he complained about a "heavy workload" which affects his planning abilities. He argued that "I do not have adequate time for planning because the workload was too heavy and because of the demands and responsibilities of the new curriculum".

Thabang indicated evidence of knowledge in aspects which relate to planning. These aspects during classroom observations related to his ability to specify the learning outcomes and assessment standards during the activity. These were evident by way of specified activities indicating learning outcomes and assessment standards reflected in his planning. The ability to indicate and also use the learning outcomes was the finding noted in the Milne and Eames' (2005) study. According to the rubric which was developed for this study, Thabang is rated as adequately sufficient. His planning levels are evident, and his planning covers all the content to be taught. Sufficient teacher activities were indicated in his unit planning and the teaching strategies were spelt out in well – written and kept planning file.

Thabo on the other hand showed little insight into aspects of planning. The absence of documented plans became apparent when he showed an inability to indicate the learning outcomes of the activity which was presented to learners in class. Glattorn (1997:100) study indicates that many teachers do not want to move away from short term planning. This was typical of Thabo who was reading his class textbook the period before the technology class started. Learner activities were given from the same textbook with no alteration or variation of the groups. Some form of planning was done however haphazard, and largely dictated by what Thabo wanted to deal with that day. As a result the learner activities were not clearly straight from the textbooks. There was little interaction in his classroom. Thabo's rating as developed for this section of the study, is sufficient. Important levels in technology were not planned for, and there were no planned learner or educator activities. Those available (short term) are not best suited for specifics in content and outcomes. A similarity which was noted about the two educators was that some form of planning was done by each teacher.

Conclusions and recommendations

In conclusion Thabo's, preparation before going to class contributed greatly to his success as a technology teacher. Popoola and Odile (2011:59) support this conclusion in their study on teachers' preparation that it ensures good delivery of lessons. This is critical and needs to be further explored as to why highly effective teachers who plan for teaching are more reflective and critical of themselves than less prepared teachers. Sometimes factors like having no control over the weight and extend of a teaching programme or being unable to use the available resources within the context disadvantages the TE teachers with their adequate planning for teaching. This section of the study provides insight into teacher's planning, and has created new unanswered questions of why planning for learning was not regarded as pertinent in the school. Another question which arose from this section was what role and support are provided by school management to assist teachers' during planning for the subject.

Findings from the empirical investigations have shown significant differences and similarities. The findings from the operating contexts of the two teachers indicated that the technology learning programme is different from other subjects. The reason is that each teacher focuses on what to plan for in order to teach at a particular time in class. It is a start, and hence a recommendation of a future studies of how the two teachers' planning impacts on learning in technology classrooms should be conducted. This recommendation was cited as a dilemma in a study by Bjurulf (2007:61) that learners encounter different kinds of learning in the same subject. As a result future research needs to look into the Technology Education classroom and the teachers' actual planning. Teachers anywhere in the country can implement technology within their context only if they can be shown how to and action research (AR) is recommended for that purpose (Mapotse & Gumbo, 2011). A further study is recommended for planning as an essential feature in the curriculum; how it has impacted on the teachers and learners' achievement of becoming technologically literate. With the gaps identified in this study, a question still remains: How far are we?

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ATTITUDE OF LEARNERS AND EDUCATORS TOWARDS THE USE OF DIGITAL SATELLITE TELEVISION (DSTV) IN TEACHING MATHEMATICS IN SENIOR PHASE

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Abstract

The purpose of this study was to explore learners and educators perceptions towards the use of DSTV in teaching mathematics in senior phase. The population of this study comprises 50 principals of rural schools. Participants were six educators whose ages ranged between 30 years and 50 years and fifteen learners whose ages ranged between thirteen and fifteen. One-on-one interviews were used to collect data. The interviews were conducted with educators and learners purposefully selected from the study site. This was because of the small number of participants who agreed to participate and also the researchers felt that the information offered was reaching a point of saturation. The results show that educators identified teacher qualification and language proficiency as a contributing factor in effective teaching and learning. In most cases, rural educators painted a bleak picture regarding lack of qualified educators that enhance quality teaching and learning. It is argued that there is an urgent need to address the participants' concerns. One limitation of this study was the fact that there was a relatively small number of respondents compared with what could have been accessed had a questionnaire been used.

Keywords: DSTV, Educators, Learner Performance, Mathematics, Senior Phase

Introduction

Challenges facing the delivery of rural education in South Africa are still in an existence. Rural educators are encountering formidable challenges as they seek to provide curriculum in their schools. The problems related to the under- development of human capability, in most cases, in black education were inherited from the apartheid era. In that system, all developmental issues related to African people in particular were either minimal or non-existent in many areas of life. This means that those who were in rural areas, including schooling, were even more neglected by that system. In fact it has been pointed out that most problems experienced in historically disadvantaged schools in South Africa are traceable to the apartheid system (Singh & Manser, 2002). Furthermore, the Department of Education [DoE, RSA] (2004) too has lamented the fact that apartheid denied many citizens access to opportunities to gain information, skills and experience necessary to develop and equip them to contribute towards economic growth. The denial of opportunities arose because of racial segregation accompanied by unequal distribution of resources in favour of whites (ibid). In fact researchers (e.g., Kallaway, 1984) have acknowledged that during the apartheid era, schooling and certain educational policies did contribute to whites unfairly advancing economically to the detriment of other races in South Africa.

It has been reported on the one hand, that lack of facilities and under- resourced schools are directly associated with the academic failure of learners (Lolwana, 2004). On the other hand, factors militating against rural learners' academic success have been identified as poor

infrastructure, poverty, and lack of supportive academic discourse (Banda & Kirunda, 2005). However, despite the increased capital budget for rural schools, it is argued that the shortage of water, adequate resources for effective learning and teaching, access to electricity, library and laboratory facilities still exists (Amsterdam, 2010). The teaching and learning of mathematics and science in such environment paint a bleak picture in some of South African schools. This study focuses on rural schools in KwaZulu-Natal (KZN) provincial department of education. Inequalities at this province have led to poor performance of learners in Mathematics, Physical Science and Life sciences (science subjects). Presently, there seems to be a difference on learner performance between the former white schools and rural schools. The researchers have observed that in KwaZulu-Natal, the predominantly Black schools in rural areas (previously disadvantaged) perform poorly as compared to former white schools (previously more resourced before 1994). Former white schools in some cases are referred to as dual medium schools. Most of the dual medium schools are usually flush with resources including good financial reserves. They generally will have fully equipped classrooms, laboratories and libraries. Sometimes the schools have fully functional media centres with the latest computer software including the internet. This suggests that the learners may use the internet for exploration and researching activities. In fact, it is reported for instance that learners exposed to positive reading climates accompanied by the availability of computers benefit their mathematics and science subjects' performance (Notten & Kraaykamp, 2009).

Theoretical Framework

Status of mathematics educators in former White schools and Black schools in rural areas

It is worth to point out that outdated teaching methods and lack of basic content knowledge in a learning area have resulted in poor learner performance (Howie, 2003). Most educators in former white schools usually are suitably qualified. For example, most experienced and skilled teachers reside in the urban areas. This is largely due to the availability and accessibility of relevant resources and facilities (Heeralal, 2014). In this regard, they are specialist in their teaching areas because they possess the requisite qualifications. Possessing good qualification has a huge advantage over educators who do not. The advantage comes from a variety of factors. For example, an educator in possession of a degree in mathematics is a content specialist in a school situation. This means that such an educator will find it easier to explain complex mathematics problems to learners. On the other hand, for educators who are not suitably qualified in mathematics it may not be that easy to do the same for their learners (ibid). The unavailability of suitably qualified educators has its ramifications. Firstly, it leaves learners taught subjects like mathematics and science by individuals who have no experience in teaching these (Heeralal, 2014; Howie, 2003; Kheswa, Sandlana & Kwatubana, 2014). Secondly, this impacts negatively on learning resulting in learners performing badly in these subjects. To address these problems, such as under-qualified educators teaching mathematics, a number of initiatives and programmes have been developed by provincial government to improve the situation (Kheswa, Sandlana & Kwatubana, 2014). From the government side, some rural schools who are underperforming have been provided with DSTVs to access the teaching of mathematics (Heeralal, 2014; Howie, 2003; Kheswa, Sandlana & Kwatubana, 2014). The installation of these technologies in classrooms aimed to enhance teaching and learning of mathematics. The resultant effect of this initiative may increase the pass rate and achievement in mathematics in senior phase and develop the

capacity of the mathematics educators (Mji & Makgato, 2006). Such classrooms, it is suggested, should provide an environment where learning is relevant, creative, and provide vibrant experiences for the learners (Davidoff & Lazarus, 2002).

Considering the huge investment needed for the installation of the new technology in some rural schools, it is important that communities should guard against any criminality within these. This means that the school (educators, parents and learners) and the community in general have the responsibility of ensuring the proper management and maintenance of these facilities. Importantly, everyone should also see to it that vandalism is prevented. In recognition of the initiative stated here, the South African government has mandated an overhaul in respect of improvements in schools (Fleish, 2002).

Statement of the problem

The development of the nation lies on the effectiveness of how mathematics is taught in schools. Mathematics plays a vital role in realising a nation's dream of rapid scientific and technological development. The consistent poor performance in mathematics poses a great threat to the scientific and technological advancement of the nation. It should be pointed out that there has been an outcry on the poor performance of Annual National Assessment (ANA) in mathematics especially in Grade 9 learners (Department of Education, 2014). Similar experiences had been experienced even before the full-scale introduction of ANA. This situation has been worsened by a large number of under-qualified or unqualified educators who teach mathematics (Mji & Makgato, 2006). It is worth to point out that black South African learners perform poorly in mathematics. For example, the study conducted in the Eastern Cape Province, where the matric pass rate continues to decline, suggested that learners are taught by unqualified educators (Kheswa, Sandlana & Kwatubana, 2014). Previously, there had been an increasing use of standardised testing programmes initiated either by national or provincial department. These testing programmes provided valid, credible and reliable information on learning achievement intended to improve quality of teaching and learning in education (Department of Education, RSA, 2015). The need to improve learners' performance in mathematics has been a serious concern to all stakeholders in the education. In fact, mathematics is a useful tool used to develop the reasoning power of learners in order to solve problems (Department of Education, RSA, 2014). Therefore, poor performance of learners in mathematics have a negative effect in the scientific age of today driven by technology in which we find ourselves. Although the study focuses on Grade 9 but it has a direct impact on grade 12 results.

Research question

The main research question of this study therefore is: *What are learners and educators perceptions towards the use of DSTV in teaching mathematics in senior phase?* To answer this question, three sub-questions were used in one-on-one interviews with the participants. The sub-questions were: *(i) Are you professionally qualified to teach mathematics in the senior phase? (ii) Which factors should be associated with poor performance in mathematics by Grade 9 learners? (iii)What are the perceptions of educators towards the usage of DSTV in their professional development in schools? (iv As a learner, do you enjoy learning mathematics on DSTV and explain why?*

In this regard the objectives of the study were therefore to:

(a) Find out the whether educators are professionally qualified to teach mathematics.
(b) Explore challenges associated with poor performance in mathematics.
(c) Find out the perceptions of educators towards the use of DSTV in their professional development.
(d) To find out whether learners do enjoy learning mathematics on DSTV.

Study site

This study was conducted in rural areas of KZN where the first author works. This in a sense means that he has first-hand knowledge of what goes on in this area's rural schools. Schools in this part of the province are faced with challenges related to the shortage of qualified educators teaching mathematics. Rural schools function in environments that are quite different from urban settings. This situation means that lack of parent involvement often have greater impact upon rural schools and educators because of complex setting in which they occur.

Method

In this study, a qualitative, non-experimental, exploratory and descriptive approach was followed (Babbie, 1998). This approach was seen as ideal, because the aim was to capture in-depth views of educators and learners. Such views would hopefully put into perspective the perception of educators and learners towards the use of DSTV in teaching mathematics. The views would provide empirical evidence whether educators and learners benefit from this initiative.

Participants and procedure

Sample

The target population for this study were the schools in rural areas of KwaZulu- Natal. Consent to conduct the investigation in all the institutions was given by the Departmental Head in the KwaZulu-Natal department of education. A sample of fifteen schools from KZN were chosen. This sample of learners from fifteen schools was chosen because they produced zero pass rate in grade 9 mathematics in 2014.

Instrument and procedure

The data were collected by means of open ended interviews. The aim of interviews was to give an independent voice to the participants. In particular each participants was encouraged to provide as honest a view as they felt was applicable to them. In collecting the data, the participants were visited in their schools. In doing this, the researchers were mindful of the argument that a researcher has to go to the setting of the study because if participants are removed from their setting, it may lead to contrived findings that are out of context (Creswell, 1998).

Validity

Validity refers to the capacity of research techniques to express the essential features of concepts being studied, and to measure what the methods were intended to measure (Leedy &

Ormrod, 2005). In a qualitative perspective validity may be defined as a contingent construct, inescapably grounded in the process and intentions of particular research methodologies and projects (Winter, 2000, p. 1). To ensure the validity of this study I ensured that all processes were consistent. For instance, I asked the same questions consistently to participants. I ensured that my views were not expressed whatsoever even when participants asked for these. I simple indicated to them that it was their views I wanted not mine.

Reliability

Reliability refers to the degree to which a measure yields consistent results (Leedy & Ormrod, 2005). It is worth to point out that reliability from a quantitative perspective is different to how it is defined from a qualitative context. It is argued that reliability is a concept to evaluate quality in a quantitative study with a "purpose of explaining" while the quality concept in a qualitative study has the purpose of "generating understanding" (Stenbacka, 2001, p. 551). To ensure reliability in this qualitative study, a number of activities were followed. For instance, principals who were intimately involved with the problems of ICT resources in schools formed part of the sample. Also, to ensure that whatever the participants said was correct, we took the transcripts to them for their verification.

Results

Here, an analysis of the collected data, its interpretation as well as the findings from the participants' perspective is provided. In particular, participants' attitude towards the use of DSTV in teaching and learning mathematics in senior phase. Importantly, actual words used by the participants are quoted in this paper.

Participants' Biographical Information

Table 1a   Learners characteristics of the sample (N = 15)

Gender	Age range	N	%
Girls	13 – 15 years	10	66.6
Boys	13 – 15 years	5	33.3

Table 1b   Educators characteristics of the sample (N = 6)

Gender	Age range	Subject taught	Experience (years)
Female 1	30 years	Mathematics	6
Female 2	31 years	Mathematics	8

Female 3	32 years	Mathematics	9
Male 4	31 years	Mathematics	7
Male 5	34 years	Mathematics	10
Male 6	35 years	Mathematics	11

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Highest qualification	N	%
Grade 12	3	50
Diploma (e.g. Diploma in Education)	2	40
Degree or higher (e.g. B.A. or B.A. Honours)	1	10

Participants Views

It is worth to point out that fifteen participants were learners from different schools and six participants were educators from different schools. Learners and educators responded to the question: *Are you professionally qualified to teach mathematics in the senior phase?* Most participants viewed teacher qualification as a contributing factor to poor teaching and learning of mathematics in senior phase. Qualification still poses a problem in many schools where some educators are under-qualified to teach. This has put pressure on management to orientate such educators. With regard to teacher qualification, all participants did not possess relevant qualifications to teach mathematics in senior phase. In this regard, participants 2, indicated that "… my qualification allows me to teach intermediate phase learners not in senior phase…" When probed how she was assigned to teach senior phase learners, she said, "I would like to be placed in the phase where I am comfortable, but due to the insufficient number of educators who teach mathematics in the senior phase, I was asked to assist because learners were stranded. On the same view, participant 1 said that "… due to shortage of educators with proper qualifications to teach mathematics, learners are compromised." On the other hand, participant 3 argued that the absence of suitable qualified educators in mathematics affect learners' performance.

In the second interview question, participants were asked: *Which factors should be associated with poor performance in mathematics by Grade 9 learners?* All the participants who were educators identified the lack of proficiency in the language of instruction as a barrier on the academic performance of learners. In fact, I asked the participants about the importance of language of instruction. They indicated that English as the medium of instruction in South Africa is used for communicating across the board with different ethnic groups. For example, participant 4 said "… using English as the language of communication is a barrier in my school …" When asked to what extent, he said "... most learners cannot construct a simple sentence in English ... We even find some educators struggling … ehh to tell the truth …" To that effect, participant 5 insisted "… It has a negative impact on the academic performance of learners." Similarly, participant 6 indicated "… English is a challenge in most learners here." When visiting a Grade 9 class to verify participant 4 assertion, we observed that the educator

explained mathematics concepts virtually using *isiZulu* the mother tongue of everyone (educator and learners). After the lesson we asked him why the teaching was almost all in *isiZulu*. He indicated that his learners were not as competent in English. We could not help but notice in our conversation that he was mixing English and *isiZulu* with us too. As we did not observe them speaking English in classroom conversations, we spoke with a few of them at the end. We noticed that indeed learners struggled to express themselves. We confirmed this with one learner at least. We asked him to read out loud from a passage from a prescribed English novel. Although he tried his best, we felt he was not used to reading a book in English. We furthermore looked at science exercise books of a few learners from the Grade 9 class of the educator we had visited. We observed that the questions learners had to answer were written in the books. These questions were in English and *isiZulu*. The educator explained to use that this was the best way of assisting learners to understand set questions in the classroom. He later said "… if I did not teach this way, I do not think my children would ever know science …"

The third question participants responded to was: *What are the perceptions of educators towards the usage of DSTV in their professional development in schools?* All participants viewed professional qualification as a contributing factor in learning and teaching of mathematics. However, in these DSTV programmes all educators who are facilitators are professionally qualified. For example, participant 2 said "… teachers who teach in these DSTV programmes are very good in terms of knowledge content …" On the same view, participant 3 argued, "… these facilitators have specific skills of teaching. The facilitators' skills are measured through learners' focus and concentration.

Finally, we asked the participants who were learners: *As a learner, do you enjoy learning mathematics on DSTV and explain why?* Here two themes emerged. The first related to the learning of mathematics on DSTV. This theme was referred to as: *Installation of DSTV in schools.* The second theme on the main was about: (a) learners' participation; and (b) understanding and working independently. This theme was referred to as: *Learners involvement.* Participants identified the availability of DSTV as something that enhance effective learning. For instance, all learners were happy about installation of DSTV in their schools. In this regard, they indicated that "… DSTV programme plays a vital role in our education and makes life so simply for us as learners …" When probed into what extent, they said "… we were never been taught before like we are practising mathematics today…" For example, after each lesson we are given an activity or homework based on the work that was presented to us. This means that we are able to practise mathematics every day. According to them, they would prefer to be taught by the same facilitators up to grade 12. About this they said "… DSTV programmes make us to understand mathematics concept so easy. With regard to learner involvement, the participants identified that the installation of DSTV has assisted them and their performance in general has improved. This issue was illustrated by the majority of the participants when they said "… DSTV programme gave us relevant skills to solve mathematics problems. Regarding this, "… we understand what to do, follow the steps as required and be able to solve problems on our own without the help from our educators…"

Discussion

The discussion presented here focuses on the rural schools because the problems that were identified were really about them than for urban schools. For example, rural schools who are underperforming have been provided with DSTVs to access the teaching of mathematics. Educator qualifications are critical because it is the knowledge and expertise that is required in helping learners to understand different subjects. For examples, participant 2 revealed that *my qualification allows me to teach intermediate phase learners not in senior phase.* Participant 1 added that *the shortage of educators with proper qualifications to teach mathematics, compromise effective teaching and learning*. About this matter it is argued that "... academic and professional qualifications of educators explain their roles of being scholars and subject matter specialist" (Robinson, 2010, p. 194). Also, it is worth to point out that "… educators should possess knowledge and skills to assist learners in solving problems, communicating clearly, making informed decisions, and in constructing new knowledge, products, or systems in diverse, engaged learning environments" (Khumalo & Mji, 2014).

Also identified by the participants was language of instruction. Here the participants identified lack of proficiency in the language of instruction as a problem. For example, participant 4 said that *using English as the language of communication is a barrier in my school.* This problem related to English proficiency means that it is difficult for learners as well as educators to comprehend and express themselves fluently in English. The issue raised by participants is vital because inefficiency in the language of teaching and learning plays a major role in learners' performance. About this matter, it is argued that learners who struggle to communicate in English are at a disadvantage, since that is the language that is used to respond to questions in the examination (Asraf & Ahmad, 2003). The language issue relating to educators may also be as a result of them being under-qualified in the subjects they teach as indicated earlier.

Regarding installation of DSTV and learner involvement in schools it is pointed out that "… knowing mathematics means being able to use mathematical concepts mathematically (Venkat, 2013). Therefore, the role of educational technology is to support the development of mathematical content knowledge, related pedagogical content knowledge and classroom competence

Study summary

In this study, the aim was to explore learners and educators perceptions towards the use of DSTV in teaching and learning mathematics in senior phase. It should be noted that the research site of this study is one of the twelve districts under the KwaZulu-Natal provincial department of education. A majority of schools in this district are more rural (60 schools) than urban (50 schools). Rural schools in particular have produced mixed student performance in the national senior certificate. Some schools and learners have performed extremely well while others poorly. The poor performance however, has unfortunately been in the majority of cases.

Conclusions and recommendations

In this paper it is indicated that participants' perceptions of the installation of DSTV in schools enhance teaching and learning and improve learners' performance. The absence of qualified educators in rural schools was perceived to be critical. This study has shown that

educator qualification is important. This factor was identified as critical in assisting schools to improve learners' performance and enhance the professional management of the school. It is pointed out that internationally "… recruiting quality teachers is a problem due primarily to the low status of teaching (as evidenced in some countries by very low salaries) and the lack of appeal found in the profession" (Cooper & Alvarado, 2006, p. 9). In terms of the recruitment of suitably qualified educators, it is important therefore that their work environment should be made conducive for them. Importantly, there is need to incentivise the educators so that they find it worthwhile to work in rural schools. In this regard, it is pointed out that if "… rural schools are to recruit personnel at least as qualified and able as those of urban areas, researchers conclude that monetary or non-monetary incentives are required" (McEwan, 1999, p. 849). It is recommended therefore that authorities in the department of education should consider to register educators with open distance learning in order to (a) acquire relevant qualifications (b) improve culture of teaching and learning (c) enhance learners' performance. Also, the department should consider incentivising educators for good and suitably qualified educator to be easily recruited.

Also the results of this study indicated that there is a serious problem about language proficiency development among educators and learners. For English proficiency, the school has to be effective and provide effective opportunities to promote language development among learners, as well as taking into account and breaking barriers that may arise. Furthermore, parents need to create a safe home environment as well as support written language and learning activities at home. Therefore, it is recommended that professionals should be involved in policy – making decisions regarding language across the school.

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BUILDING INSTITUTIONAL REPOSITORY IN ACADEMIC DIGITAL LIBRARIES: REQUIREMENTS AND IMPLEMENTATION ISSUES

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Abstract
Institutional Repositories (IRs) are works of scholars produced within an academic institution. These works provide comprehensive and up-to-date information on studies carried out by members of an institution and are invaluable in education. The resources are being increasingly generated in academic institutions without proper management systems thereby making access and use of the resources difficult, hence, the need to build an effective management system that will enable the collection, organisation, preservation and dissemination of the resources to increase institutional visibility and enhance teaching, learning and research. The purpose of the paper is to discuss the requirements and implementation issues for building IR in Academic Digital Libraries. Specifically, the steps taken to install, configure and customize Dspace on Linux (Ubuntu) platform in University of Nigeria, Nsukka are presented. Then the challenges encountered and their solutions are highlighted. The paper provides knowledge on personnel, software and hardware needed to build IR. It also helps institutions planning to implement IR to understand the steps followed to set up IR so as to provide global access to local content, increase the visibility of an institution and enhance teaching, learning and research.

Keywords: Institutional Repository, Digital Libraries, Dspace, Ubuntu, Open Source, visibility

Introduction

Institutional repositories (IR) are output of studies carried out by members of an academic institution. According to wiseGeek (2016), an academic institution is any degree-granting institution that is dedicated to research and education. Through research, academic institutions generate a lot of content locally, commonly referred to as local content. Uzoegbu (2012) defines local content as a way of making the relevant locally generated knowledge and experience of a community visible. The content may include staff papers, theses and dissertations, journal articles, conference proceedings, technical papers (Walters, 2007), and other types of intellectual output.

The library as a citadel for information resources has the responsibility to collect, organise, preserve and disseminate these resources. With the potentials of Information and Communications Technologies, these resources are being digitized and housed in digital libraries but without proper information management systems to capture, process and provide global access and use to the resources. Ezema (2010) posits that the greatest problem facing scholarly publications is the inability to make them globally visible. The paper states that even though local contents contain quality information, they are neither indexed and abstracted by international indexing agencies nor captured in any database, hence they have poor or limited visibility and accessibility.

IR is a new concept for selecting, organising, disseminating, and preserving scholarly works created in electronic form by faculty and students ((Vishala & Bhandi, 2007). IR promotes electronic publishing, enhances indexing of documents, preserves digital materials for long term and provides global access to information (Sivakumaren & Jeyapragash, 2007). As a result of the viability of IR software in the management and dissemination of IR, many institutions are desiring to implement IR. Existing literatures have focused on the management and utilization of IR with little or no information on the practical implementation. This paper is aimed to fill this gap.

Implementing IR software requires both human and material resources. Human resources are the personnel who provide the services needed, while the material resources comprises the facilities and information resources required to get IR up and running. This work discusses these issues in addition to the steps taken to set up, configure and customize IR in University of Nigeria, Nsukka (UNN), as well as the challenges encountered and their solutions. While the purpose of setting up IR may vary, in most cases, IR is built to provide Open Access to the research output of an institution. This need, in addition to the potential high cost of proprietary software has led many institutions to go for Open source software, hence our choice of Dspace as the IR software.

The objectives of this paper are to provide information on the human and material resources needed to implement IR; share the experience of implementing IR in University of Nigeria, Nsukka by presenting the steps followed to install, configure and customize Dspace; and encourage other libraries desiring to implement IR in their libraries so as to provide global visibility and unlimited access and use of IR in teaching, learning and research. In addition, the paper presents the challenges encountered and their solutions.

Methodology
To provide detailed discussion on the issues regarding the building of IR in digital libraries using University of Nigeria, Nsukka experience, existing literature were consulted using web information. Also a variety of installation manuals were downloaded and used. Useful information was obtained from interacting with Librarians of Nnamdi Azikiwe Library, University of Nigeria, Nsukka and people from other University libraries who have implemented IR. Practical hands-on experience on the installation, configuration and customization was done to test out the implementation process.

Findings
It was discovered that IR increases institution's webometric ranking and hence the visibility and impact of an academic institution. For instance, UNN was ranked 10th in Nigeria Universities in 2014 but having implemented IR in September 2015, the University was ranked first in Nigeria Universities, 14th in Africa and 136th in the world as can be seen in Goggle scholar Webometrics ranking (2015).

What is Institutional Repository (IR)?
Institutional repository (IR) was born out of a need to manage the digital contents of institutions for effective utilization. IR provides an opportunity for information management professionals to collect, preserve and disseminate the intellectual output of their organisations. According to (Bhardwaj, 2014) & (Boufarss, 2011) an IR is a way of ensuring that the published and unpublished works of scholars is made globally accessible to the

academic community. Crow (2002) In Gozzetti (2006) defines IR as digital materials that capture and preserve the scholarly output of a single or multi-university community.

The contents of IR may include monographs, electronic academic journal articles, electronic Theses and Dissertations (ETDs), digital assets generated by staff of institutions such as administrative documents, course materials, learning objects and conference proceedings. Since the year 2000 when IR was first developed, a number of software have been deployed to run IR.

Digital Library and IR Contrasted

A repository and a digital library are not synonymous. Malan (2004) defines a digital library as a managed online environment that provides a user an integrated access to a variety of information sources without the barriers of space and data format. An IR on the hand is an electronic archive that provides free and open access to the intellectual output of an organisation. A digital library is a gateway to electronic resources that include IR and other resources such as Online Public Access Catalogue, e-books, e-journals and databases (Lawton, 2013). A repository under normal circumstance adheres to open access while some digital library services may be closed access.

Dspace

DSpace is an open source institutional repository software that is used to build open access repositories of the intellectual output of institutions. Software is Open Source if it has no copyright restrictions but rather its source code is made available with a license permitting a user to modify and distribute to anyone and for any use. Source code is programming statements that direct a computer on how to perform specified task(s).

Dspace is a brain-child of Massachusetts Institute of Technology (MIT) and Hewlett Packard. It was developed originally to address the need of information preservation and dissemination for MIT. It is used mainly as an archive system to gather, manage, preserve and disseminate digital contents. It is the most common software used by academic institutions and commercial-based organisations for building open digital repositories. It is easy to install and customize to the taste of any organisation (Biradar & Banateppanavar, 2013). Dspace supports a variety of data formats and content types such as text, images, audio, and video.

Dspace can run in a variety of operating systems (OS) including Windows, Linux distributions (including Ubuntu, Debian, Fedora, Mandriva, OpenSuSE), Unix and Solaris. Linux is the most preferred operating system for Dspace because it is free and more reliable.

Requirements for Implementing IR
Personnel Requirements

Implementing IR requires the knowledge, skills, and abilities of people well versed in different disciplines. Building a successful IR requires first and foremost a Librarian for selecting, organizing and managing the content. In addition, a librarian is needed to manage the people working on the repository as well as undertaking the content policies, advocacy, user training and reaching out to the faculty and departments for content submission and other issues.

In implementing an IR, a network expert is needed to set up the network to ensure Internet connectivity during system installation and use. A Computer Scientist is needed for system set up and customization. In addition, a computer scientist is required to undertake quality assurance and may double as web master to update the contents of web pages according to management guidelines

In text conversion, low-level personnel are required for typing and scanning materials. Additional staff may be needed to collect and organise the materials according to subject categories to ease the work of staff working on the conversion of materials. Subject specialists may also be needed to edit the materials after typing and scanning. These however depend on the need of an institution.

Hardware requirements

Hardware is the physical components a computer system that can be seen. IR is basically a network system and therefore, makes use of existing network technology. The technology connects the system to users and to the required information. IR requires a computer acting as a server and a network as basic hardware requirement. Along with personal computers serving as workstations, cables are essential connectors of the IR infrastructure. They are the critical elements without which the system could not function. Electrical wiring and telecommunications cables are fundamental components necessary to connect the user computers in the local network.

Interconnecting networks requires linking various pieces of computer equipment such as network cables and routers. A router is a device that permits traffic to be directed efficiently from one network to another. The IR system also requires printers for printing search results as well as scanners and multimedia equipment.
The hardware used for the University of Nigeria, Nsukka IR and their functions are listed below

Hardware name	Function
HP ProLiant ML350p Gen8 - Xeon E5-2609 2.4 GHz, 8 GB RAM	Server machine on which the OS, Dspace and other software dependences and information resources are stored
HP ProLiant ML350p Gen8 - Xeon E5-2609 2.4 GHz, 8 GB RAM	Used as backup
HP Printers	For printing out documents
Epson GT-15000 Scanners	Used for scanning print materials
UPSs	For temporary power backup
Inverters	For power backup

Software Requirements

Dspace runs with many software dependencies. Basically, Dpsace requires an Operating System (OS) to run. Below is a list of software used in setting up IR for University of Nigeria, Nsukka.

Software name	Function
Ubuntu 12.04.LTS	Server Operating System

LAMP server	Web server used for creating and hosting websites and web applications.
TOMCAT Java Server	Web server used to serve JavaServer Pages (JSP) and Java programs
Postgres	Back-end database software
Ant	Build tool for Apache software
Maven	Build tool that describes how software is built and their dependencies
Adobe Professional	For file conversion
XML	Used to develop mark-up rules for encoding documents
CSS	Language used to describe the presentation of documents written in mark-up language

Choice of Operating System

Ubuntu is a Linux-based operating system. Default installation of Ubuntu contains a wide range of software which saves cost and effort on the part of the user. Ubuntu version 12.04.LTS was used to implement the IR. The choice of Ubuntu as the operating system for Dspace is based on the following criteria

- It is used as the server operating system at no cost
- Security: it has no risk of virus attack and it has frequent updates which does not require paying for new versions
- It is reliable and not subject to frequent crashes
- Speed: it is relatively faster than other operating systems
- It has timely community support
- It is preinstalled with useful support software such as Open Office which saves cost on the part of an institution
- It has 64bit architecture support for improved programming environment

Steps to Implementing IR
Installation of Ubuntu Operating System

This installation process assumes a fresh installation on a server that has no existing OS. The first step in implementing IR is the installation of the Operating System. To do this, Ubuntu was downloaded and burnt into a DVD and the following steps were taken to install the OS.

Step 1: The DVD was inserted into the bootable CD/DVD drive and the installation instructions were followed

    1.   Note: Because the installation will require the installation of Updates and third party software, the next thing is to set up the network information necessary to obtain Internet access. It is advisable to assign a static IP to the server to ensure a more stable connection. The network information is specified by entering the IP address, Network Mask, Gateway, DNS and Search Domain information appropriately as in the boxes shown below
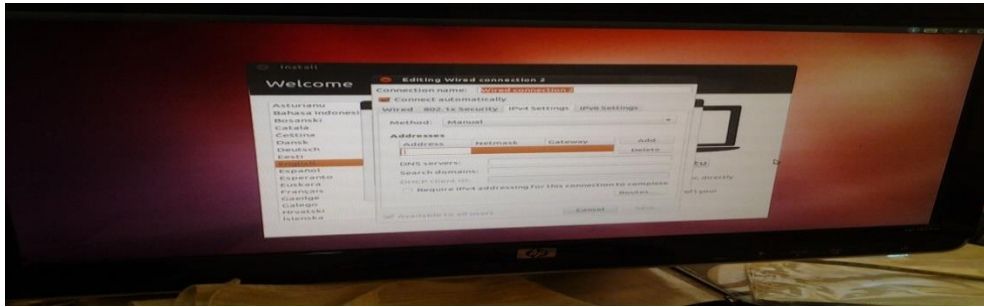
Fig.1: Template for specifying the wired network connection

Step 2: Here, the identity of the server was specified. Specification of the identity of the server is very vital in the installation process. The Dspace user account was created as shown in the template
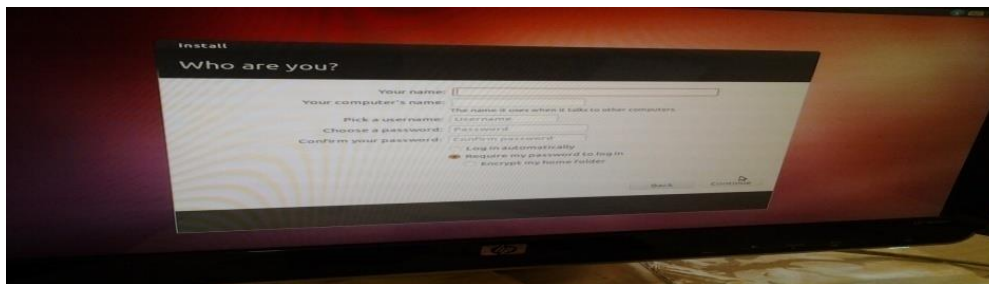

Fig. 2: Template for the creation of Dspace user account

Step 3: When Ubuntu installation is completed, then the software was updated and upgraded by typing - sudo apt-get update, and sudo apt-get upgrade
Step 4: Installation of Dspace dependencies
Step 4a: Installation of java-openjdk version 6 and task selector was done by typing
        apt-get -y install openjdk-6-jdk tasksel
Step 4b: Then task selector was run by typing, tasksel
Step 4c: Selection of the tasksel options - LAMP Server, PostgreSQL Server and Tomcat Java Server
    Using TAB, the options were selected, ENTER was pressed when done
Step 4d: Installation of the ant and maven utilities was done by typing, apt-get -y install ant maven
Step 5: Creation of a dspace database with password dspace was done by typing su postgres
    createuser -U postgres -d -A -P dspace
    Note: dspace as password is entered twice and n is selected when asked to specify roles
Step 6: Using a text editor, the following line was added to the file,
     /etc/postgresql/9.1/main/pg_hba.conf by typing
     Sudo nano /etc/postgresql/9.1/main/pg_hba.conf
The following information is added at the end of the file - local all dspace md5
Step 7: postgresql is restarted using the command - /etc/init.d/postgresql restart
Step 8: A unix user named dspace is created and is located at Dspace install directory using, useradd -m -d /var/www/dspace dspace
Step 9: A password for user dspace is created using the command passwd dspace
When asked dspace is entered as password

Step 10: Postgres dspace database was created as user dspace by typing su dspace followed by a command - createdb -U dspace -E UNICODE dspace

Step 11: tomcat6 for dspace is configured by adding the following lines to /etc/tomcat6/server.xml just before the line with </Host> using nano text editor

<!-- Define a new context path for all DSpace web apps -->
<Context path="/xmlui" docBase="/var/www/dspace/webapps/xmlui" allowLinking="true"/>
<Context path="/sword" docBase="/var/www/dspace/webapps/sword" allowLinking="true"/>
<Context path="/oai" docBase="/var/www/dspace/webapps/oai" allowLinking="true"/>
<Context path="/jspui" docBase="/var/www/dspace/webapps/jspui" allowLinking="true"/>
<Context path="/lni" docBase="/var/www/dspace/webapps/lni" allowLinking="true"/>
<Context path="/solr" docBase="/var/www/dspace/webapps/solr" allowLinking="true"/>
save the file.

/var/www/build/ directory was created where dspace source was saved by using the command mkdir /var/www/build/

Step 12: Dspace is then downloaded from its source address to the directory already created by using the command

Wget http://sourceforge.net/projects/dspace/files/DSpace%20Stable/3.4/dspace-3.4-src-release.tar.gz

Step 13: The archive was extracted to a directory named "build" under /var/www/ using the command

tar -zxvf dspace-1.8.2-src-release.tar.gz.

Step 14: **Configuring Dspace**

Dspace was configured to suit the need of our institution by editing the following fields in the dspace configuration file named dspace.cfg

   i.   Dspace.dir=/dspace was changed to */var/www/dspace*
   ii.   dspace.hostname = localhost t was changed to dspace.hostname = http://repository.unn.edu.ng
   iii.   dspace.base Url = http://localhost:8080 was changed to dspace.base Url = http://repository.unn.edu.ng:8080
   iv.   dspace.url = http://localhost:8080/xmlui was changed to dspace.url =http://repository.unn.edu.ng:8080/jspui

Step 15: Dspace binaries was built using mvn software by using the command
cd /var/www/build/dspace-3.4-src-release
mvn -U package
Step 16: The binaries were installed using the command
cd /var/www/build/dspace-1.8.2-src-release/dspace/target/dspace-3.4-build/
ant fresh_install
Step 17: The ownership of the installed dspace was changed to tomcat6 by using the command
chown -R tomcat6:tomcat6 /var/www/dspace
Step 18: tomcat6 was restarted by typing, /etc/init.d/tomcat6 restart
Step 19: The dspace administrator account was created by typing
        /var/www/dspace/bin/dspace create-administrator
Step 20: The installation was tested on localhost by typing
http://localhost:8080/jspui/ or http://localhost:8080/xmlui/   on the address bar of the browser.
Then the installation was tested using server fully qualified domain by typing

http://repository.unn.edu.ng:8080/jspui/

Linking the Repository to Digital Library Website.
To provide global visibility and access to the IR, the IR link need to be created in the institution's library website using an IP or fully qualified domain of the IR. In the case of UNN, this was done by the ICT centre in charge of the University's website .

Dspace Customization
Dspace has two user interfaces – JSPUI and XMLUI. The choice of user interface determines to a large extent the type of customization to be made. Basic customization can be done in the configuration file – dspace.cfg. To perform advanced customization, the first thing is to assign file permission to the file by typing the following

2. Type su root, and enter the root password
3. Type chown*<your username>* –hR<the *folder containing the file to customize>*. This gives <your username> full read/write access to all the files in *<the folder containing the file to customize>* and its sub folders. Then when a file is to be edited then, right click on the title of the file in its folder list, click on 'Properties', click on 'Permissions', and select read/write access by changing the default setting, then close the window. For instance, to change the image in the header, follow the path
4.   /var/www/dspace/webapps/xmlui/themes/mirage/images/apple-touch-icon.png or dspace-logo-only.png (assuming the installation folder is /var/www). Rename the header image, copy your own image to the folder and give it the original default image name and save it. Notice that there are 2 header images, so you need to rename the 2 and give their names to your own images. Customization can also be done by create files or editing existing files using programming approach.

Challenges to Implementing IR and Solution Approach
In spite of the interest that implementing IR creates in academic institutions, and its usefulness in the management and dissemination of local contents, problems that hinder its implementation abound. In our earlier paper "Evolution of Digital Libraries in Nigeria: Problems and Prospects" (Inyiama & Asogwa, 2011), most of the problems encountered in implementing a digital library are also applicable in implementing an IR because IR is a component of a digital library. Some these problems which we encountered during the implementation of IR in UNN include:

Lack of Fund
The success of any project depends on the financial involvement of the administration of the institution. The implementation and maintenance of IR is very expensive. Money is needed to buy the required hardware and required licensed software. The fund was not easy to come by at the commencement of the implementation project. The library administration had to seek the support of the University administration through the Vice Chancellor before the needed resources were procured.

Internet Connectivity
IR runs on networks. To a large extent, the existence of a university WAN, LAN and Internet connection within the library determines the success of IR implementation. This was a major

challenge to University of Nigeria, Nsukka. Internet connectivity was very low during the initial period of the implementation. This slowed down the process of the implementation adversely. Some installation that may take about an hour or less to complete such as Ubuntu installation took several hours. To overcome this challenge an appeal was made to the ICT centre of the institution that manages the University network, and a dedicated bandwidth was assigned to the IR server which facilitated the progress of the implementation.

Power Supply
The success of an IR cannot be assured without power supply. Regular power supply remains a problem in Nigeria. UNN library experienced epileptic power supply during the process of the implementation and the cost of running generating plants was high. This seriously constrained the process. To address the issue, inverters were procured and used to provide prolonged power supply.

Content Digitization
In order to build a viable IR, physical materials must be converted. The available technology for digital conversion at the unset of the digitization was of low quality which often reduced the quality of digitized materials. To address this issue, quality scanners were bought which then produced high quality digitized output.

Copyright Issues/Access Restriction
Copyright is a major issue in setting up IR. Most authors do sue the library for violating copyright law if the library did not seek their authorization before putting their work on the IR. This was why UNN started putting up theses and dissertations on the IR first since the copyright belongs to the University and not to the individual authors.

Lack of Technical Support
Implementing an IR requires appropriate technical skills. Such technical support were not readily available during the commencement of the implementation. Most times the systems being used for the IR developed technical problems but there were no technical support to handle the problem. Also, a network expert was not part of the implementation team and this created a serious network issue. The ICT centre was then called in to be part of the team and with that the implementation was completed successfully.

Summary and Conclusion
This work discusses the requirements for implementing IR and the implementation process.
The Nnamdi Azikiwe Library, UNN started the implementation process by constituting a policy implementation committee made up of the library's top management staff. Their terms of reference were to decide on the choice of IR software, set up policies and regulations regarding metadata rules, copyright policies, and staff training guidelines. Next, a team of three (3) members of library staff – a Computer Scientist, a Computer Engineer and a Librarian was constituted to take up the practical implementation of the IR. The selection of the team members was based on their skills which were considered relevant for the project.

The implementation exercise lasted for eight months. The work commenced by sourcing for installation manuals and other relevant documentations from the Internet and interviewing technical and professional staff from University of Nigeria and other Universities that have already implemented IR. Then the IR software (Dspace) and its dependencies were

downloaded and used for the project. A lot of challenges were encountered during the installation and configuration processes. The greatest challenge faced during the installation process were lack of steady power supply and poor Internet connectivity. For instance, some installation processes (such as running mvn package) that may, under normal circumstance, take less than an hour lasted for up to 6 to 8 hours when Internet connection was low and often the process may be interrupted by power outage when the process has gone up to 95%. Another challenge was getting Dspace to root mail from the application environment. It was later realized that it was a network problem and not basically application-related problem. At this point, Network experts from the University's ICT center were consulted. The information obtained from them enabled us to surmount the problem. Then Dspace was successfully installed, configured and customized to the taste of our institution, after which the system was put into use.

Having implemented IR in September 2015, the University was ranked first in Nigeria Universities, 14th in Africa and 136the in the world as can be seen in Goggle scholar Webometrics ranking (2015). This shows that implementing IR in academic digital libraries increases an institution's webometric ranking and hence the visibility and impact of an academic institution. Considering the benefits of implementing IR in academic institutions, it is recommended that academic digital libraries that have not yet set up IR should consider implementing IR as a matter of urgency. However, implementing IR may seem easy, and the IR software can be downloaded and used at no cost, but the challenges involved may be daunting if not properly addressed. It is recommended that before undertaking the implementation of IR software, steady power supply should be put in place as well as dedicated Internet connectivity. It is also recommended that an Electronic Engineer with practical networking skills should form part of the IR implementing team so as to address the necessary network requirements for running the software.

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USING EDUCATION THROUGH SOCIAL MEDIA IN COMBATING GIRL-CHILD ABUSE

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Abstract
Girl-child abuse remains one of the silent challenges today's society faces. Developed and developing countries are plagued with this challenge and although a number of policies and regulations have been put in place to curb this acts, cases of child abuse continues to rise. This may explain the rising cases of teenage pregnancy, early marriages, child labour and child trafficking that are currently being reported across the globe. Education through social media has been identified as one of the essential components towards societal advancement. Smoking, corruption and other vices have enjoyed media coverage and enlightenment efforts. However, no aggressive enlightenment campaign has been carried out on girl-child abuse. This paper therefore, seeks to critically analyze the need to effectively use education through social media as a tool in combating child abuse and also assess empirically, the effectiveness and impact of social media in tackling the abuse of the girl-child. The data were obtained using a structured questionnaire which in random was administered to residents of Anambra State, Nigeria. The findings from data analysis indicate that abuse can have mental and physical impacts on the victim and if not checked may have devastating effects on the society as a whole. From the data analysis, it can also be inferred that social media equips and enlightens the populace particularly the girl-child on the issue of abuse. The research also highlights that the effect of the social media is wide spread encompassing politics, religion and human relationship and that the effectiveness of social media in curbing the abuse of the girl-child through education faces obstacles in illiteracy, poverty, culture and some government policies. Hence, it can be concluded that violence against the girl-child has become a contemporary issue that no nation can ignore. This paper therefore contributes great knowledge to the society.

Introduction
Today's society is plagued by a whole lot of challenges contributing to societal degradation. One of such challenges is the abuse of the girl-child. The girl-child abuse is a global phenomenon, that both developed and developing countries are faced with and although policies and laws have been passed to curb the re-occurrence of this, it continues to grow and in some cases cause devastating effects on the psychological and physical wellbeing of the victims as well as loss of reputation to organizations whose staffs have been indicted in such acts. From physical abuse to genital mutilation, feminicide, early marriage, sex trade and child labour the girl-child faces abuse and ridicule across all strata of the society. The publicized case of Ese Oruru, the 14 year old girl from Bayelsa State who was kidnapped from Bayelsa and married off in Kano state Nigeria to her abductor Yanusa Dahiru (Osahon, 2016) and the BBCs' Jimmy Saville rape case (Boffey, 2014) are clear examples of the scope and extent, child abuse has contributed in societal degradation.

Child abuse therefore maybe defined as acts intentionally carried with a view of inflicting harm to a child (WHO, 2002). Furthermore, it can be described as the deliberate use of force physically or psychologically to carry out acts that have the possibility of causing

developmental disruptions as well as injuries to the mental and physical state of a child (Portwood, 2006; Nuszkiewicz, 2012).

The abuse suffered by the girl-child range from physical punishments to other degrading treatment at the hands of their parents, other members of the family and individuals charged with their care in child protection facilities, schools and workplace. Supporting this view, Pinhero (2006) postulates that, the girl-child is exposed to mental violence and abuse sexually across the different environment where she grows up such as, the home front and school. The effect of abuse during childhood have been found to be highly variable as the long term effects may include problems maintaining stable relationships, intimacy issues, lack of trust, alcohol or drug abuse, mental disorders (Nuszkiewicz, 2012).

One of the first reported cases of girl-child abuse occurred in 1874 when a nine year old Mary Ellen Wilson was rescued by Etta Wheeler from her parents and the events that transpired during this period led to more efforts being made to protect the rights of children (Myers, 2008). However, despite such efforts most countries do not have an effective response to the abuse of the girl-child. Some of the identified difficulties include; lack of information, understanding of the scope and characteristics of the abuse especially when it occurs within the family to mention a few (Pinhero, 2006). Evidence indicates that only a small proportion of the violence perpetrated against the girl-child is reported and investigated by authorities and few offenders brought to justice this is as a result of fear of their abusers and possible consequences (DFID, 2005; London, et al, 2005; Samuel, 2011). Poverty, cultural beliefs, enlightenment with regards to education and understanding of child protection laws have been identified as major causes of girl-child abuse (Mangvwat, 2010; Onyido, 2015).

Education therefore, has been identified as one of the means to curbing this menace. Education can be defined as the process of passing on information, skills and training to an individual or group of individual with the aim of attaining a desired target (Offorma, 2009; Onyido, 2015). Chidebulu (2010) further posits that education is a process that seeks to intellectually, effectively and mentally advance a person with the purpose of assisting him contributing positively on the society at large. Education as such, can be deduced to be an essential tool towards societal development as no nation can attain greatness without educating its citizens in order for them to be equipped to contribute effectively and efficiently to the growth of the economy and society (Onyido. 2013). According to Umoru (2015) education is a tool that seeks to integrate individuals effectively into a society with a view to attaining self-realisation, promoting togetherness and enhancing national consciousness. Alufohal & Ezeani (2012) further opine that education liberates the populace from ignorance and in turn stimulates development.

From the above definitions it can be deduced that the effectiveness of education thus ranges from a number of areas which includes developments of skills, greater understanding of maternal health, gender equality, child rights and improved standard of living for the populace (Onyido, 2015). Educating the populace on child rights will go a long way in enlightening the populace on the effects of some degrading cultural practices for example; the effects genital mutilation and early marriage may have on the mental and physical wellbeing of victims.

As earlier discussed education is transferring information from one person to another or a group of people. It can therefore be deduced that education cannot occur without communication. Over the years the means to communicate has evolved and today we have "social media". The term social media refers to the wide array of internet based and mobile services which allows its users to participate in the exchange of information online. Internet services associated with social media include:

- Blogs
- Wikis
- Social Bookmarking
- Social Network sites
- Status-update Services
- Media Sharing sites
- Virtual world content (Dewing, 2010)

Thus, social media is the future of communication, it employs a countless array of internet based tools and platforms which improve the possibility and capacity of sharing information, making it easier to transfer text, audio, video and information and as such making it easier to raise awareness on any topic.

This paper therefore seeks to highlight the importance of using education through social media as a means of curbing girl-child abuse. Media campaigns and slogans have been designed to tackle smoking, AIDS, drunken driving, corruption and even animal abuse; however, the abuse of the child is still in dire need of an aggressive campaign (MMWR, 2001).

History of Social Media
During the 1990s, the broadband internet grew in popularity, websites sprung up that allowed its users to create contents and upload them for public consumption (OECD, 2007). In 1997, the first social network site was launched and called SixDegrees.com (Dewing, 2010; Edosomwan *et al*., 2011). It allowed users to upload a profile and to interact and make friends with other users. The current social media explosion that is being experienced today started in 1999 and experienced the advent of blogging and sites like Myspace, LindedIn became popular in the early 2000s and by 2006 Facebook and Twitter grew in popularity (Edosomwan *et al*., 2011). Today, the social media is fast growing and millions of people use social media platforms.

Platforms such as Google, Facebook, Linkedin, Twitter, Wikipedia and Instagram have created online communities where members can share information with other members and as at November 2012, Facebook announced that it had 1 billion users globally whereas Twitter announced an estimated 517 million users globally in July 2012 (Dewing, 2010). Hence, it can be inferred that the social media provides a medium for an enormous amount of information to be easily created, searched, shared, promoted and disputed. It is a two–way communication stream whereas in other conventional media, communication is one way as such information without disputing for example, through the radio, newspaper or the television. Hence, for the abuse of the girl-child to be tackled effectively, social media usage must be embraced. Social media has the power to create awareness of the girl-child abuse and make the issue become a priority in the minds of the populace as well as alter the attitudes of

people while providing an outlet for the abused to reach out to relevant authorities with a lot more confidentiality and ease (Nuszkiewicz, 2012). In the Nigerian context social media provides a public platform for agencies, organisations and governments to spread the word regarding their existence, preventive tools and efforts.

Impact of Social Media
Social media has impacted politics, today governments and politicians use the social media to spread their news of their achievements and plans. They have become more weary of their actions because at a very fast pace information about them can be spread through social media to anywhere in the world (Shirky, 2011). Scholars have highlighted that the Arab Spring specifically the Egyptian Revolution in 2011 was largely affected by the social media (Elantawy & Wiest, 2011). In 2007, French media suggested that social media had an effect on the voting decisions that saw Nicolas Sarkozy the centre-right UMP party candidate secure victory over his opponent Segolene Royal of the socialist party (Auvinen, 2011). Social media has also impacted businesses, today advertisement of products are increasingly been done through social media platforms. Companies are using social media to build customers loyalty, seek for employees and procure equipment and this process is a lot cheaper compared to television advertisements and other expensive forms of marketing (Jackson, 2011).

Proponents have argued that although social media is fast spreading, certain cultures have resisted it. They argue that social media erodes the existing culture (Murray, 2011). Social media encourages free speech, in certain cultures in Asia and Africa this is greatly frowned upon. In Russia for instance, there is a clampdown on the use of Facebook (Guardian, 2015). In some countries such as Cuba, Facebook is difficult to access and in China it is claimed that as at September 2015 about 3,000 websites including Google and YouTube were blocked in Mainland China, this may be attributed to be the reason, Google withdrew from China (Kuang, 2011).

Another school of thought posits that social media platforms such as Myspace, YouTube, Twitter have developed intercultural relationships in the virtual community as a result of the creation of a network of personal connection (Boyd & Ellison, 2007; Chen, 2012). According to Elola & Oskoz (2009) the use of blogging has a positive effect on the development of intercultural relationships and also increases the degree of participants intercultural communication competence.

Scholars have also highlighted that social media though beneficial to the populace can also be detrimental if not properly monitored (Murray, 2011). Qian & Scott (2007) stress that revealing too much personal information on social media can have negative implications and can have jeopardize efforts in establishing constructive human relationships intraculturally and interculturally. O'Keefe & Clarke-Pearson (2011) point out that most social media sites are frequented by today's children and adolescents and as a result of their limited capacity for self-regulation they are susceptible to peer pressure and at the risk of experimenting with the social media. Research indicates that if left unchecked, they are exposed to online bullying, sexual experimentation, internet addiction and sleep deprivation to mention a few (Strasburger et al., 2013).

Statement of the Problem

Child abuse is the deliberate application of physical and psychological force to carry out acts which have the possibility of bringing developmental disruptions to the victim. In the face of this abuse, the girl-child faces more abuse as a result of cultural and physical discriminations and continues to be marginalized and discriminated in life.

The increasing cases of rapes, kidnapping, child prostitution, early marriage to mention a few can be attributed to lack of education. There is need therefore, for the populace to be educated on the need to protect the girl-child against abuse and this can be achieved through the social media. As research indicate the growing influence of social media on the decision making of organisations and governments. It is estimated that an average of 3 in 5 women have been abused at one point in their lives by either family or peers. This can have devastating long time effects on such women thus the need for education through social media.

Objectives of the Study

This research seeks to assess the effectiveness of education through social media in curbing the abuse of the girl-child specifically:

To assess the accomplishments of education towards preventing girl-child abuse.

To examine education through social media as it relates to the girl-child.

To examine challenges facing social media education in relation to girl-child.

To critically analyse the findings of the investigations and proffer recommendations on possible actions to embark on to further curb girl-child abuse.

Research Questions

To what extent is social media curbing girl-child abuse compared to other means in Anambra State of Nigeria?

To what extent are the rising cases of girl-child abuse, the failure on the part of the government and agencies?

Null Hypotheses:

There is no significant difference between the effects by social media and other means in Anambra State of Nigeria

There is no significant difference in the challenges facing girl-child abuse in relation to social media and government efforts in Anambra State.

Methodology

The design employed for this study is the survey research and adopts an interprevist philosophy, since the study is focused on a social phenomenon that can be observed with regard to curbing girl-child abuse through the use of social media. This research employs both primary and secondary data. Saunder et al., (2012) postulates that primary data can be said to be information that is deliberately obtained for a study whereas secondary data may be referred to as information that is collected from other sources such as databases of companies, organisations and from journals for example. For this study, Interview is used as the method of primary data collection and the population used for the study consists of adults residing in Anambra state in Nigeria. It is estimated that about 4million people reside within Anambra State. From the senatorial districts in Anambra State, 300 adults were selected applying the non-probability sampling technique. It is important to highlight that the main instrument for this study is a structured questionnaire named "Curbing girl-child abuse through the use of Social Media" consisting of a total of 6 questions. The split half method

was used prior to collection of data to ensure reliability of the instrument. Applying the Pearson Product-Moment Correlation their scores were correlated to obtain a correlation coefficient of (+0.68). The split half method was then applied on the correlation coefficient (+0.68) to obtain +0.81 which indicates that the instrument is reliable since it is greater than +0.68.

Data Analysis
Research Question One:
With the intention of examining the effectiveness of the social media in curbing girl-child abuse compared to other means participants of the questionnaire were asked:

In your opinion, do you think social media has been more effective in curbing abuse of the girl-child than other means of creating awareness?

Do you think an adult who is active on the internet is more enlightened and less likely to commit abuse on the girl-child?

In your own opinion, do you think the girl-child who is exposed to social media is better equipped to handle abuse?

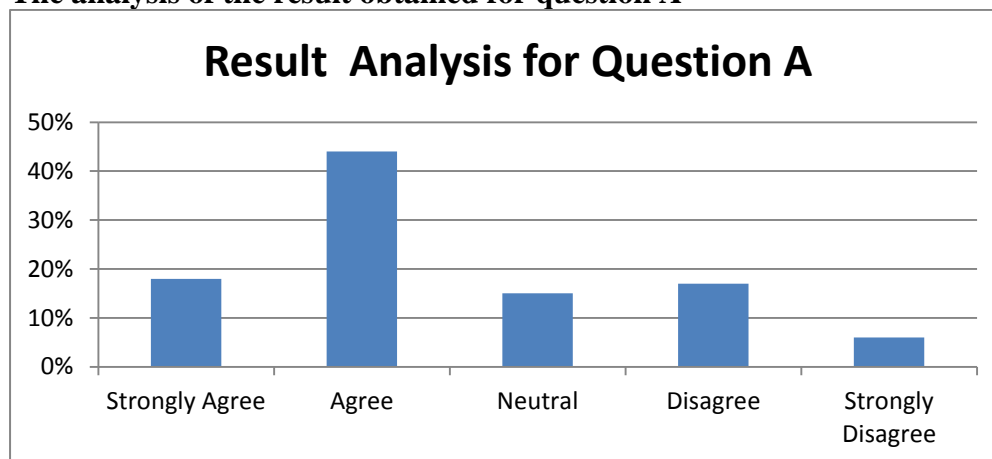**The analysis of the result obtained for question A**

Figure. 1 Result of Question A: "In your opinion, do you think social media has been more effective in curbing abuse of the girl child than other means of creating awareness?

According to O'Keefe & Clarke-Pearson (2011) Social media aids authorities become better equipped to handle cases of abuse as well as know the amount of girl child abuses in an area. With social media, accessing health information and reporting cases of abuse is a lot easier. The outcry that was generated as a result of the Ese Oruru case is a clear example of its effect on the fight to curb the abuse of the girl-child (Ani, 2016; Thisday, 2016). This explains why in Figure.1 above, 42% of the participants agree that social media has been effective in curbing abuse against the girl-child.

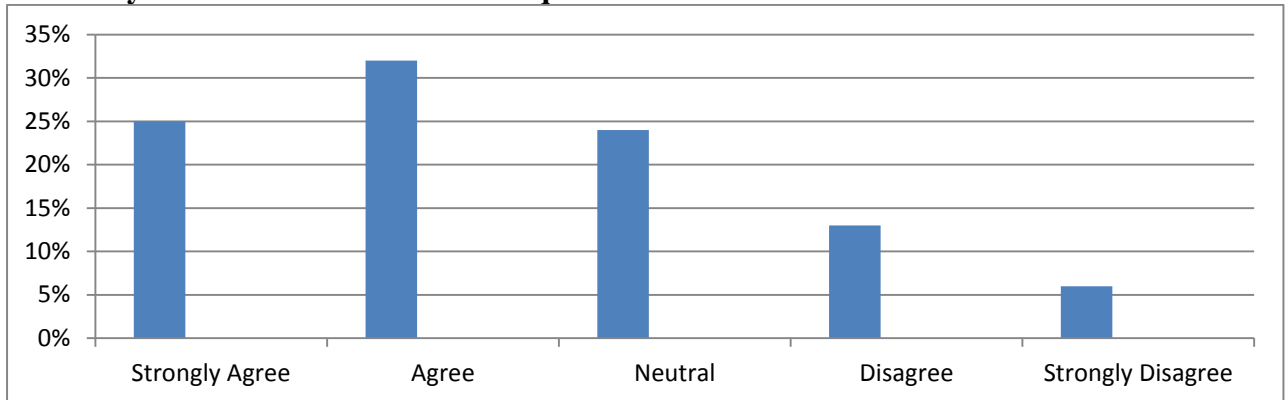**The analysis of the result obtained for question C**

Figure 2 Result of Question B: Do you think an adult who is active on the internet is more enlightened and less likely to commit abuse of the girl-child?

From Figure 2 above, 33% of the participants agree and in addition 25% strongly agree that an adult who is active on the internet is more equipped to avoid being abusive to the girl-child. Nuszkiewicz (2012) postulates that when an adult is active on the internet they tend to come to understand the psychological and physical implications of child abuse and they tend to avoid being abusive. However, Miller-Perrin & Perrin (2007) argue that an estimated one-third of children who suffer from abuse or neglect during their childhood will in the future engage in abuse. This explains why in Figure. 2, 23% of participants were neutral and 13% disagreed with the proposition.
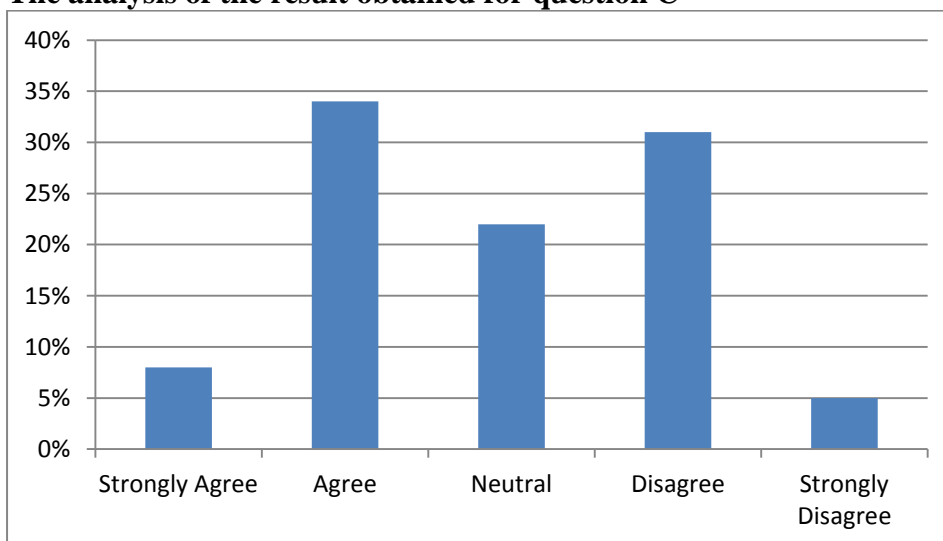
The analysis of the result obtained for question C

Figure. 3 Result of Question C: In your own opinion, do you think the girl-child who is exposed to social media is better equipped to handle abuse?

From the above figure, it can be deduced that 8% strongly agree with this proposition are supported by 34% who agree. This view agrees with scholars who highlight that when a child under the supervision of her parents can better informed about her surroundings and become more aware of certain unacceptable acts by adults around them they can reach out to her parents or relevant authorities if abused (Goddard & Saunders, 2001). However, another school of thought argue that social media can also be a source of abuse for the girl-child.

They posit that cyber bullying, stalking and sexting to mention a few are experiences a girl-child will face if she is active on the social media and these can lead to psychosocial outcomes (O'keefe & Clarke-Pearson, 2011). This view explains why 31% of the participants disagreed with this proposition and are supported by 5% of the participants who strongly disagreed with this proposition.

Research Question Two:
With the aim of examining if education through social media faces challenges in relation to the abuse of the girl-child, participants were asked: Do you think, families who are un-educated and are privileged to use social media platforms discriminate against the girl-child more than families who are educated and use social media platforms? In your opinion, do you think government policies aimed at educating the populace on need to protect the girl-child through social media are effective? Do you think social media is beneficial to culture?
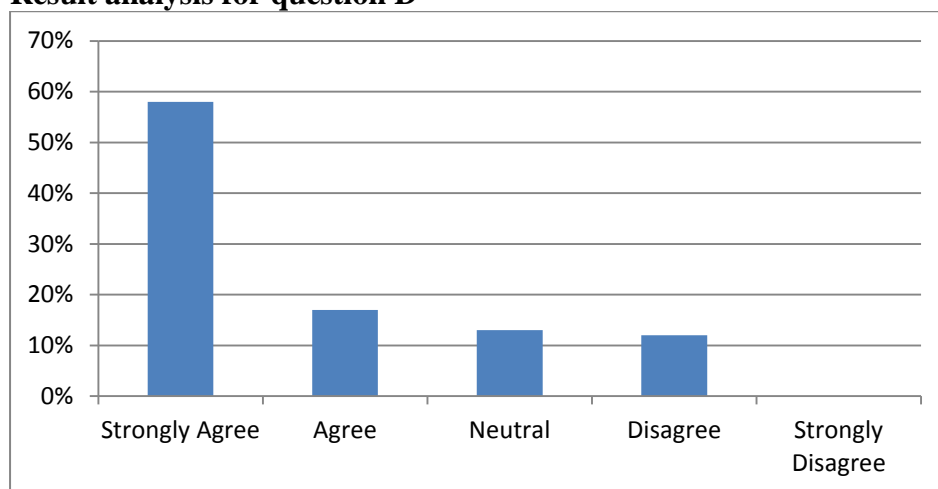
Result analysis for question D

Figure. 4 Do you think, families who are un-educated and are privileged to use social media platforms discriminate against the girl-child more than families who are educated and use social media platforms?

Education is an effective tool in preparing one for the demands of the society. Today's society is ever evolving and new challenges are arising, hence in order to stay at par with the rest of the community education by whatever means carried out, must be undertaken. In the African context however, it is believed that the girl-child duties remains in the kitchen and when faced with financial difficulties are comfortable scrapping the idea of educating the girl child (Onyido, 2015) Social media exposes parents to the benefits of gender equality (DFID, 2005). The figure above (Figure 4) which represents the views of the respondents to Question D, indicates that 59% strongly with the proposition whereas a negligible 11% disagree.

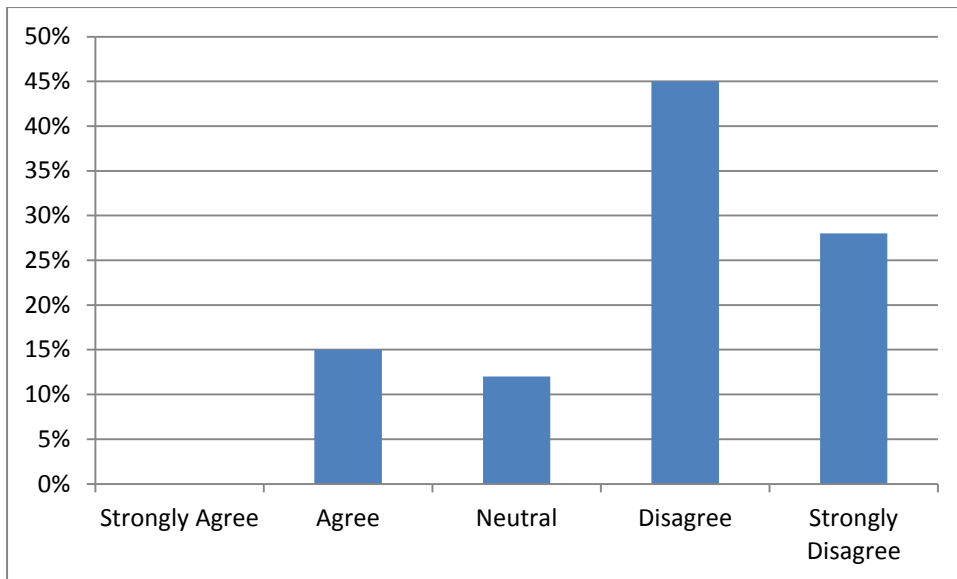**The analysis of the result obtained for question E**

Figure. 5 In your opinion, do you think government policies aimed at educating the populace on need to protect the girl-child through social media are effective?

Over the years, different policies have been introduced to protect the child against abuse. A country that fails in its efforts at developing the skills and capacity of its populace will find it difficult attaining its full potential (Onyido, 2015). From the Figure above (Figure 5) above shows that participants of the research indicate that a greater percentage disagree with the proposition that governments are doing enough through social media to curb violence against the girl-child. However, another of thought have argued that most victims are not equipped to use the social media to report cases of abuse to the necessary authorities or fear ridicule (Pinhero, 2006), hence, they propose that if the populace embraces the use of social media adequately most policies set aside by the government will be effective. This explains why 15% of the participants agreed with this proposition of Question E.
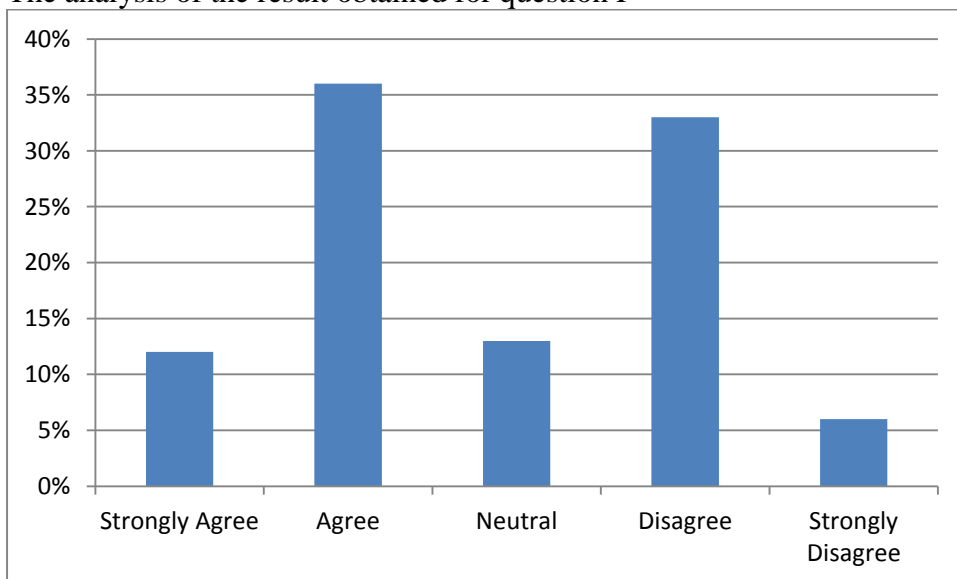
The analysis of the result obtained for question F

Figure 6 Do you think social media is beneficial to culture?

Culture refers to the language, beliefs, values, customs, dress, skills, knowledge that is acquired by a group of people. Cultural identity therefore is derived from membership in these social groups. From the figure above (Figure. 6) it can be deduced that 13% as well as 36% respectively of the participants strongly agreed and agreed with the proposition of (Question F), this maybe in line with proponents who stress that social media has brought about cultural understanding and tolerance (Boyd & Ellison, 2007). Chen (2012) further posits that social media is causing rapid globalization and convergence of cultures, thereby making it easier for people of different religions, ethnicity to be able to communicate with each other. Singh (2010) suggest that the internet has caused individuals to be inducted into "virtual culture" as opposed to the traditional communities that are bound by physical and face to face communication. These virtual cultures can alter and threaten pre-existing cultural identities. This may explain why 33% and 6% of the respondents disagreed and strongly disagreed respectively with the proposition of (Question F) while 12% remained neutral.

Conclusion

Girl-child abuse is a growing social problem that cuts across every cadre of the society. This research has highlighted some of it effects and the need to use education to curb its growing scourge. As the societal degrading phenomenon being experienced as a result of the abuse of the girl-child is a cause for concern. The research highlights that efforts have been carried out to curb other aspects of societal degredation and little has being done to tackle abuse of the girl-child and if left unchecked by relevant authorities, will have detrimental effects on the society at large.

This study identifies educating through social media as a means of curbing abuse against the girl-child. Social media is far reaching; today's society has become more dependent on the use of social media social platforms. Social media platforms such as Twitter, Facebook, Instagram, Watsapp, Snapchat, Linda Ikeji blog are visited by millions of people on a daily bases. It can be deduced from this study that social media is not only a means of making money but can also be used to develop, train and alter the attitudes of the populace to which they have been arguments regarding the detrimental attitudes that social media can imbibe as well as the positive and self-realization benefits as well as attitudes that can be imbibed from educating through social media.

This study has established from the above discussions and data analysis that educating through social media can be effective in the fight against the abuse of the girl-child. It also stresses that a nations full potential may never be attained if this violence against the girl-child is not tackled. Furthermore, it establishes that social media has an effect on politics, culture. Findings also from literature and the views of the participants indicate that poverty, cultural and political sentiments affect social media and in some cases contribute to the spread of girl-child abuse. It also highlights that as a result of social media, the girl-child is more aware of authorities to reach out to when abused. It is therefore imperative for greater efforts to be made in order to effectively use social media platforms to equip the populace with the necessary knowledge and skills to protect the rights of the girl- child**.**

Recommendations:

More efforts should be put in place in curbing abuse against the girl-child through the use of social media by educating parents on the need to protect the rights of their girl-child. In addition, the use of social media should be introduced in monitoring cyber bullying and harassment, government at all levels should adopt legislative measures aimed at ensuring that every girl child is not denied her rights. Furthermore, non-governmental organizations and advocacy groups should participate more in introducing programmes that will encourage the use of social media by adults with a view to enlightening the populace on the implications of the abuse of the girl- child. It is also recommended that early marriages be avoided as it denies the girl-child the opportunity to pursue any academic dream. Finally, budgeting for gender based programmes should be advocated for in order to tackle gender disparities.

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ASSESSMENT OF AND UTILIZATION OF ICT FACILITIES IN SOME SELECTED NURSERY AND PRIMARY SCHOOLS IN ODEDA LOCAL GOVERNMENT AREA OF OGUN STATE, NIGERIA

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Abstract
The twenty first century is experiencing advancement in every sphere of human existence. The most striking development is the infusion of information and communicating technology into every aspect of living. Consequently, it calls for   the emergence of new model of learning, new skills and competences, and development of teaching methodology to meet up with the divers challenges. This study investigated the availability and utilization of ICT facilities in selected nursery schools in Odeda local government area of Ogun State, Nigeria, The study also assessed how learners are being equipped for the future challenges and needs of the twenty first century. Random sampling technique was employed to select 19 schools and 100 teachers for the study. Basically, data were collected with the aid of structured open and closed ended questionnaire. The findings showed that computer was the highest available ICT facility. Also, 76.4% of the respondent opined that computer was not taught in the nursery section of their schools. The study revealed that the teachers' perception of the use of ICT among the preschoolers is right. The preschoolers 100% had non- access to computers in all the selected schools. The study queries the reality and possibility of empowering the learners at this level of education.   This study recommends among others, adequate training in the use of ICT facilities for nursery teachers and exposing of preschoolers to ICT.

Key-words: Training, preschoolers, availability and utilization.

Introduction

The twenty first century has been acclaimed as an era for communication, creativity, collaboration and critical thinking Shame (2006). It has been characterized with witty invention and technological advancement. Virtually, every sphere of existence has been invaded with information and communications technology Kozma (2008). This era in human history require that learners obtain different set of skills and expertise for survival Scott (2011). Consequently the school which is the major social structure for socialisation and reconstruction must be re-envisioned to train and empower learners (the future working force), so as to function with minimal distress in the new arising order Leis (2010). Early childhood education has been identified as the foundation for all other forms of learning. The early years have been identified as a period when the brain architecture is consolidated. The right and early experiences a child is exposed to causes the brain structure to be well developed to support and aid future learning, behaviour and health Harvard (2007). In support, Browne (2014) opined that the frontiers of neurosciences have revealed the plasticity of the brain in the early years. Consequently, for effective empowerment of learners for the 21st century, the foundation of education must be revisited with the sole intention of infusing it with the necessary content and skills that will equip the learners at these formative years.

Learning in the 21st century has completely metamorphosed into a different operation entirely. According to Toki & Jerry (2014), ICT has created new educational environment. lt has affected relationship between the teacher and learners, altered the kind of work and the kind of free time now available in most setting. The skills and content   useful in the last century certainly is no more functional. Zaranis (2013) speaking on the teaching and learning in the 21st century emphasised the need for new competence, new culture and new strategies. In order to survive and escape the stressors that are waiting to emanate from an evolving new order, both national and international educational policies have tried to inculcate ICT into all curriculum. lt was in the light of these that Article 17, United nation convention on the right of the child emphasised the role of the government to encourage children access to information on mass media, TV and internet content services UNESCO(2010). Since the development and advancement in this century is certain as the dawn of a new day, it is pertinent to assess the availability of and the utilization of ICT facilities in order to ascertain and plan for the future. Consequently, the paper seeks to find answers to the following questions.

What is the level of availability of ICT in Nursery schools?

 What is the level of utilization of computer and internet facilities in Nursery schools?

Do the Nursery school teachers have formal training on computer application?

Do the Nursery school teachers perceive the use of ICT as appropriate among the pre-schoolers? With the afore- mentioned, the study seeks firstly to examine the availability of ICT facilities in the study area. Secondly, assess the utilization of ICT facilities by the pre-schoolers, thirdly, examine the perception of teachers on the use of ICT facilities among the pre-schoolers and lastly to examine the professional competence of the teacher in the nursery session on the use of ICT.

Study Hypothesis

H0:   Nursery school teachers' do not perceive the use of ICT as appropriate among the pre-schoolers

Hi: Nursery school teachers' perceive the use of ICT as appropriate among the pre-schoolers.

Theoretical Framework

The term "ICT" encompasses much more than just computers. ICT can be defined as "anything that has an effect on the environment using electronic or digital equipment, permit retrieving and receiving and storing information, and communicating with each other, Siraj-Blatchford &Whitebread [2003]. lt includes digital still and videos cameras, mobile phones, electronic keyboards and toys.

This research was guided by Albert Bandura theory of social learning, Bandura, (1977). The theory proposed that human behaviour is learnt observationally by modelling. He believed

that people learn from watching each other and even most importantly can gain new information from this observation. According to him, formation of new ideas does come with observation. Learning, according to his theory can be laborious and sometimes hazardous when there is no guide.

ICT has been acclaimed by many researchers for example, Bruce (2010), Clement, Nastasi and Swaminathan (1993) and Becta (2008)) to be of immense benefit to the teaching and learning process. This can likely be attributed to the fact that ICT allows learning to takes place as learners observe according to Bandura's theory. Hayes and Whitebread, (2006), emphasized that ICT promote literacy and mathematical skills, if appropriately utilized. The way ICT is utilized particularly how teachers provide oversight during teaching is of great importance. Zaranis (2003) also in support was of the opinion that ICT can improve learning and help children in developing good self-esteem. This can be said to be possible as learners observe and imitate what is taught. The relevance of ICT in learning appears to be eminent when guided by Bandura theory. The benefit of ICT cannot be made manifest if learners are not allowed to copy and imitate the action of the teacher during the teaching section. Siraj-Blatchford strongly asserted the roles of ICT in achieving the objectives of the curriculum. On the contrary, Hans (2003) disagree to a certain extent on the use of ICT in teaching in the early years. He believed its use can only be actualized when used appropriately by teachers. UNESCO (2010) however gave seemly unchallengeable negative facts about the use of ICT in early years. The harmful physical effect as regards the health of children, negative exposure and children become passive recipients was emphasised. The negative effect on social and cognitive development was also considered. On the overall, a critical review of any process certainly will expose both the advantageous and disadvantageous parts. The only way to utilize any process and enjoy the benefit is to give an unbiased assessment and seek for positive ways to reduce the impact of the undesirable aspect. Siraj-Blatchford and Whitebread (2003) ascertained the use of ICT to be beneficial if used appropriately.

Methodology

Quantitative method was considered appropriate for this study. The study is cross –sectional study design Kumar (2015) set to assess a phenomenon by studying a cross section of a society at specific point in time. A questionnaire was developed and validated for the research by the researchers to elicit information from teachers in the nursery sections of the selected schools. The instrument had two sections. Section A collected information on the demographic characteristics of the respondents, while section B is 4-point Likert scale where the respondents were to tick their level of agreement on items which reflected their perception on the use of ICT among the pre-schoolers.

Participants and Data Collection

Since the purpose of the study was to examine the availability of, and assess the utilization of ICT facilities in Odeda local government area of Ogun state, Nigeria, the participants for this study were drawn from teachers working in the nursery and primary schools in the study area. A sampling frame was constructed by randomly selecting nineteen nursery and primary schools in the study area. Due to privacy and confidentiality regulations names and numbers of teachers at selected school are not mentioned. The total numbers of participants were ninety-five (95). Ninety-five (95) questionnaires were retrieved out of which six of them were

not valid for analysis. Data were collected with the aid of structured open and closed ended questionnaire. The questionnaires contained items that sought to identify types of ICT facilities available for use in the schools, and learners assess to these facilities. The views of nursery teachers on the relevance and use of lCT was also sought. Descriptive statistics, frequency, distribution and tables were used to analysis the data obtained. The chi-square analysis was used to test the stated hypothesis. The chi-square calculated was compared with the chi-square observed for decision making the chi-square model is stated as follows

$$X^2 \text{ calculated} = \frac{\sum (O - E)^2}{E}$$

Where O= Observed frequency
E= Expected frequency
The expected frequency is obtained as follows
$$E = \frac{CT \times RT}{GT}$$

Where:

CT = Column total
RT = Row total
GT = Grand total

The hypothesis was tested at 5% level of significance.

Results and Discussion

Table 1: Distribution of Respondents by Professional Training on the Use of Computers.

Training	Frequency	Percentage (%)
Certificate of proficiency	41	46.1
Diploma in desktop publishing	11	12.4
Other form of training	9	10.1
No training	28	31.4
Total	**89**	**100.0**

The Table above was computed to examine the professional competence of teachers on the use of ICT. The result shows that majority of the teachers (46.1%) obtained certificate in proficiency while 12.4% of them had diploma in desktop publishing. It is also evident from the table that 10.1% had other form of training on the use of computer for ICT. The result implies that it would still be difficult for some of the teachers to impact the ICT knowledge on the pupils and hence the need to intensify training for them.

Table 2: Availability of ICT facilities in nursery schools

	Available	Not available	Total
Computers	56(62.9%)	33(37.1%)	89

D.S.T.V	48(53.9%)	41 (46.1%)	89
Internet facilities	28 (31.5%)	61 (68.5%)	89
Power supply	72 (80.9%)	17 (19.1)	89
Computer room	56 (62.9%)	33 (37.1%)	89
Total	**260 (58.4)**	**185 (41.6)**	**445 (100%)**

In the assessment of availability of ICT facilities in the nursery schools, Table 1 shows that computer is the highest available ICT equipment in the schools with 62.9% followed by D.S.T.V with 53.9%. The least available facility is internet with 68.5% of the respondents affirmed that internet is not available at all in their nursery schools. The non-availability of computer and other related facilities could constitute and hindrance in embracing ICT among the pre-schoolers.

Table 3: Utilization of ICT facilities among nursery schools

Items	Yes	No
Access to computer room	-	89(100%)
Pupils allowed to work on the computer	-	89(100%)
Pupils allowed to play games on GSM	4(4.5%)	85(95.5%)
Teaching computer in nursery schools	21(23.6%)	68(76.4%)
Pupils allowed to browse on the net	-	-

The results from Table 2 above show that the level of utilization of ICT facilities among the nursery school pupils is very low in the study area. It is evident (76.4%) of the respondents confirmed that computer was not taught in their nursery sections while all the respondents (100%) submitted that the nursery pupils had no access to computer room. As regards the internet's facility, the result shows further that the nursery pupils were not allowed to browse the net despite its availability in some schools. This might not be unconnected with the opinion of nursery school teachers who believed that the nursery pupils are too young to be exposed to the usage of ICT facilities such as computers, internet and mobile phones. This view is in contrast with the submission of Siraj-Blatchford (2010) who opined that educational setting in Nigeria should strive and provide the child in school access that is meaningful in ICT. Hayes and Whitebread (2006) also affirmed that when children learn something by computer they learn knowledge that is represented textually, mathematically, graphically and photographically. They asserted further the need to prepare the 21st century pre-schoolers for the challenges ahead of them given the overwhelming in flow of ICT into every sphere of human activities. This is supported by Aremu (2004) who submitted that the

propagators of information technologies and new media of instruction should inculcate the educational value of use of computer games into their courses at all levels of instruction so as to facilitate the effective implementation of policy guiding the ICT and the child.   .

Testing of Hypothesis

H₀: Nursery school teachers' do not perceive the use of ICT as appropriate among the pre-schoolers.

Table 4: Testing of Study Hypothesis Using the Chi-square

S/N	STATEMENTS	SA	A	D	SD	TOTAL
1.	ICT application cannot be integrated.	19 (24.8)	26 (24.0)	12 (17.2)	32 (23.0	89
2.	ICT (computer, mobile phone e.t.c) will make this child to be playful in class.	14 (24.8)	10 24.0)	16 (16.2)	49 (23.0)	89
3.	ICT facility in my school is adequate.	22 (24.8)	26 (24.0)	20 (17.2)	21 (23.0)	89
4.	ICT (computer mobile phone e.t.c) make the children to fight in class.	18 (24.8)	14 (24.0)	36 (17.2)	21 (23.0)	89
5.	Computer, mobile phone e.t.c. will help the pupils to work together.	31 24.8)	36 24.0)	11 (17.2)	11 (23.0)	89
6.	Computer can be use to teach other subjects e.g. Maths, English, French.	45 (24.8)	32 (24.0)	8 (17.2)	4 (23.0)	89
	Total	**149**	**144**	**103**	**138**	**534**
		χ^2 **cal 122.48**	χ^2 **tab 25**	**Df 15**	**P<0.05**	

An analysis of table above reveals that the χ^2 cal value of 122.48 is greater than the value of χ^2 critical of 25.0 given 15 degree of freedom at 95% confidence level. Thus, this result is significant at 5% therefore; null hypothesis that Nursery school teachers' do not perceive the

use of ICT as appropriate among the pre-schoolers is rejected, while the alternative which says that Nursery school teachers' perceive the use of ICT as appropriate among the pre-schoolers is accepted. Thus, it can be concluded that Nursery school teachers' perceive the use of ICT as appropriate among the pre-schoolers. This is corroborated by the result of the interview whereby 57 (64%) of the respondent opined that the ICT facilities in their schools are inadequate and therefore should be improved upon. It is also evident from the above table that 65 (73%) disagreed with item two which says that ICT (computer, mobile phone e.t.c) will make the child to be playful in class. Hence, ICT facilities are perceived by the teachers as instructional materials and not mere toys that can distract pupils' attention while learning.

Discussion of Findings

From the data collected the main ICT equipment available in the area of study is the computer. Some of the schools 62.9% have computers while all the schools 100% do not have internet facilities. As regards DSTV facilities, 53% some of the sampled school attest to having these. However, the utilization of these facilities by the pre-schoolers appears not to be a priority in the sampled area. None of the privately founded schools allow the pre-schoolers to gain access into the computer room not to mention the use of it. With all the benefit of ICT at this level of education coupled with the arising need of the 21st century, it is observable this sets of learners may be left out from gaining from what is supposed to be available and accessible to them. Majority of the teachers, 68.6% are quite knowledgeable and familiar with the use of ICT with only 31.4 % needing training. Perceptions of Nursery school teachers on the use of ICT in aiding the learning of other subject appear to be right. The mind set of preschool teachers about the use of ICT reflect that they are aware of the relevance of ICT in preschool education, nevertheless this is not strong enough to motivate the preschool teachers to introduce the pre-schoolers to the practical classes in ICT. Although, ICT facilities are available to some extent, there still exist mental barrier limiting its effective use. This is because 48.6%of the Nursery school teachers are of the opinion that it can aid fighting in the class. From the above study, some ICT facilities are available but the aspect of utilizing the available resources still need to be re- addressed to ensure that learners truly are been prepared to meet the challenges ahead.

Conclusion and Recommendations

This study examined the assessment of availability and utilization of ICT facilities in selected nursery schools in Odeda Local Government Area. The findings reveal that Nursery school teachers perceive the use of ICT facilities as appropriate among pre-schoolers; some of them require training on the use of computer. Also internet facilities were not available for use in all the nursery school used in the study. It can therefore be concluded that the utilization of ICT among the nursery schools pupil is very low. The study therefore recommends the following:

1) Adequate training on the use of ICT facilities should be given to the nursery teachers in the study area.

2) It is important to improve power supply in the school to facilitate the use of internet facilities.

3) Nursery pupils should be allowed to have access to ICT facilities in their respective schools.

4) Polices should be put in place to ensure that government and private school owners should provide ICT facilities at various levels of instruction including the nursery section.

5) It is also recommended that policy researchers should carry out this study on a large scale.

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ONE LAPTOP PER CHILD RWANDA: ENABLING FACTORS AND BARRIERS

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Abstract
The Rwandan government has, to date, deployed over 210,000 XO laptops to 466 (out of 2711; 17%) primary schools as part of the international One Laptop per Child (OLPC) initiative in an attempt to implement sustainable, higher quality education. Access to technology alone does not imply improved learning outcomes. This paper evaluates the enabling and constraining factors to improving educational outcomes in the OLPC-Rwanda project, with particular focus on professional development of teachers.

Fieldwork was conducted in Kigali over two weeks in May 2015. Students, teachers, OLPC trainers and Rwandan Education Board staff were observed, interviewed and surveyed. Enabling factors include a dedicated, well-intentioned and goal-driven local team, although their efforts are focused on technology delivery and deployment targets instead of improved learning. Barriers include hardware limitations, ineffective use of laptops and inadequate professional development of teachers (TPD). Major aspects of the project (such as TPD), were passed off as the duty of other stakeholders, leaving gaps.

It is suggested that effective TPD should be implemented to influence classroom pedagogies. This should incorporate the interactive use of educational technologies across curriculum-based lessons to improve learning outcomes. Ultimately, the focus should shift from deployment to TPD, support and maintenance. Student-to-laptop ratios should be re-considered, factoring in cost-efficiency and equitable access.

Keywords: Rwanda, OLPC, educational technologies, teacher professional development

1.   Introduction
Having commenced in 2007, the One Laptop per Child-Rwanda (OLPC-Rwanda) project provides a unique opportunity to measure long-term impact, as it is one of the longest running large-scale educational technologies projects in Africa (OLPC, 2011), yet it has not been evaluated in terms of its effectiveness to improve learning. Sustainable, equitable, quality education for all encompasses the development of knowledge, values, and skills of people to participate and contribute to society and is thus a means to sustainable development. Effective use of educational technologies (edtech) can be a contributing factor in achieving sustainable education (Power, Gater, Grant & Winters, 2014). The Rwandan government, to date, has deployed over 210,000 XO laptops to more than 466 primary schools (out of 2711, 17%) as part of the word-wide OLPC initiative (OLPC, 2014; Education Statistical Yearbook, 2014). Access to technology, however, does not necessarily imply improved learning outcomes.

This paper highlights the importance of the human aspects in the sustainable implementation of educational technologies in developing countries, namely, a focus on teacher professional development (TPD), rather than on mere technology delivery.

2. Background

In many developing countries, investments in educational reform and edtech are justified by the need for economic and social development (Hennessy et al., 2010). While the formulation of these policies has been comprehensive and articulate in order to attract donors, the implementation has been less successful (ibid.; Power et al., 2014). A prerequisite to integrating edtech into education is creating technology-literate, confident teachers, capable of agency and leadership (Hennessy et al., 2010). TPD is a widely recognised way of achieving this. Hennessy et al. (2015) categorise the challenges and opportunities for TPD into three factors; teachers, schools, and the wider community/policy context. Most importantly, teachers need to move from a "technology focus" to a "pedagogic focus" (ibid.*;* Power et al., 2014).

In 2005, Seymour Papert, Nicholas Negroponte and Alan Kay decided to practically implement the constructionism theory, "learning to learn" (Papert, 1980), by starting the OLPC initiative as a means to help children in the developing world (Christoph et al., 2009). OLPC's self-directed learn-by-doing ideology was envisaged to compensate for the lack of teachers and mitigate large student-to-teacher ratios present in developing countries (Christoph et al., 2009). The XO laptop, the main product sold by OLPC, embodies a *frugal innovation* design approach by decreasing complexity and cost, whilst increasing durability (Radjou et al., 2012). The laptops, a product of a collaboration between academics and industry, are rugged, relatively low-cost, energy-efficient, easy-to-use, easy-to-learn and have a variety of educational content and software on it (OLPC, n.d.).

Before the implementation of OLPC in Rwanda can be discussed, a brief understanding of Rwandan history and culture is necessary. Due to the genocide in 1994, Rwanda suffered from immense turmoil but has seen vast improvements. This is reflected in the Human Development Index, a measurement of long-term progress, which increased by 73.8% since 1980 (UNDP, 2014) Rwanda has made undeniable progress in education, health, gender equity, and economic growth (Farrell et al., 2007). For example, it decreased learner out-of-school populations by 93% from 2006 to 2011, the biggest relative decrease reported (UNESCO, 2014, pp. 68). Additionally, the literacy rate over the age of 15 is 70.50% (UNDP, 2014).

The partnership between OLPC and Rwandan Ministry of Education (MINEDUC) officially started in 2007 with the deployment of 750 XO Laptops to Grade P5 students at a rural school called Rwamagana. As of 2015, Rwanda is the third largest OLPC deployment in the world, after Peru and Uruguay (OLPC, 2013). In reviewing past literature on the OLPC-Rwanda project, the main themes that emerge are the roles of headmasters and teachers, multi-stakeholder engagement, TPD, and the challenges and opportunities in implementing sustainable edtech programmes. Whatley (2011) discusses the unequivocal role that headmasters play in the OLPC project, arguing that for the project to be implemented successfully in schools, principals need to prioritise the project, be motivated, and be empowered to react creatively and adaptively. Additionally, headmasters influence the teachers' level of motivation in the project (ibid.). Fajebe's (2013) analysis of the teachers' viewpoints, indicated that teachers seem to think of the OLPC project as a computer literacy and rote-learning project. Fajebe acknowledges that teachers need time to adapt and integrate new methods to successfully incorporate edtech into the classroom (ibid.). These reviews

provide a strong background, against which the OLPC-Rwanda project's progress in overcoming its challenges can be measured.

Building on existing literature, the following research questions were identified:
1. What are the enabling factors and constraining barriers to improving educational outcomes in the OLPC-Rwanda project?
2. What is the current and potential role of teacher professional development and pedagogy within the project?

For the purpose of this research, we use the term *training* to refer to short-term technology-focused events, whilst *edtech-integrated teacher professional development* (TPD) to refer to sustained opportunities for teachers to acquire both the pedagogical and technical insights and skills in order to use edtech interactively in lessons (Hennessy et al., 2015).

3. Methodology

A constructivist philosophical approach is used as it subscribes to the notion that meaning is constructed by subjects and consequently, there can be various accounts of the same reality (Gray, 2005). This approach was useful as stakeholders had conflicting opinions that needed to be represented. This research was carried out through fieldwork in Kigali, Rwanda to study a subject's actions, objects, and society from the perspective of the subject themselves.

Quantitative and qualitative research into OLPC learning experiences was carried out in four schools. Data was collected through approved structured paper surveys (37 with teachers at the four schools), audio-recorded semi-structured interviews (22 with principals, teachers, local OLPC-Rwandan Education Board (OLPC-REB) staff and volunteers), and various video-recorded classroom and training observations (Adam, 2015). Rwandan policy documentation was also reviewed. To ensure reliability, data was triangulated (Gray, 2005), through different methods of enquiry and different informants. As only four schools were reviewed, this was not intended to be a representative study of all teachers in Rwanda. Schools were chosen based on rural-urban classification, varying distance from head office, varying time since the schools received the laptops, and availability.

4. Enabling Factors and Constraining Barriers Interview Results

Interviews were transcribed and coded thematically to identify the enabling factors and constraining barriers of the OLPC-Rwanda project, in terms of its capability to improve learning.

4.1. Enabling Factors

Government Initiative - The Rwandan government took the initiative and approached OLPC. There is strong determination from MINEDUC and OLPC-REB to improve the country's situation and there is a strong belief that improving education will help to achieve this goal thus there is considerable financial investment:

> *"There is a political will to make sure it works" (TEMP, Interview 21)*

Improved Infrastructure - Laptop use required infrastructure such as electricity and functional classrooms. The project thus drove infrastructure to be implemented. Although infrastructure was not necessarily used for its intended purpose, it improved the quality of the schools (Former OLPC, Interview 14).

Efficient Deployment - The process of deployment has been perfected and streamlined. The principals come to the OLPC-REB office, complete the paperwork and are briefed. Simultaneously, the warehouse staff prepares laptops for dispatch, systematically keeping track of allocations to schools. Principals then collect and deliver the laptops to school. After dispatching laptops to approximately 50 schools, OLPC-REB staff switch to providing OLPC-training to the schools that have just received laptops (OLPC-REB, Interview 17). The process is then repeated. Upon inventory, OLPC-REB knows exact allocations of laptops to schools (OLPC-REB, Interview 17).

Localised Adaptions - REB introduced the E-solutions software which contains content based on the Rwandan curriculum. The content on the laptops is adapted to the Rwandan context, using Rwandan nature and culture in pictures (OLPC-REB Trainer, Interview 7). For example, the laptop contains programs to increase malaria awareness. Understanding of English was not crucial as it works intuitively. At a school level, technological local adaptions were evident. For example, rather than using the expensive OLPC designed docking station for charging, a local electrician solved the problem cost-efficiently by making a long wooden multi-socket, enabling laptops to be charged simultaneously.

4.2. Constraining Barriers

Top-down Management - Initiative was taken from MINEDUC with little community engagement thus it was still a top-down approach:

> *"The government makes the decisions and there is not much community voice nor investment of time and effort in creating a means for society to adapt to the intervention" (Former OLPC, Interview 14).*

Understaffed - Whilst OLPC-REB is extremely dedicated, their efforts are focused on deployment. OLPC-REB has approximately fourteen trainers to train 466 schools, whilst concurrently managing deployment (OLPC-REB, Interview 18). Additionally, all the trainers are IT specialists and are not proficient in subject pedagogy.

Obsolete Technology - The laptops hardware was released in 2005 and the same model, with minor software improvements, is still being deployed in 2015. The technology is outdated and obsolete.

Inefficient Use of Funds - The project has not been assessed in terms of its value-for-money. The exact costs of the project have not been disclosed but the costs add up to *at least* US $60 million (OLPC-REB, Interview 17). Even assuming this project was value-for-money, finance is prioritised for purchasing laptops and not investing in human capital such as trainers (OLPC-REB, Interview 17).

Success Criteria - The success of the project is currently measured by the number of laptops deployed (OLPC, 2013), rather than how often they are used or what broad impact they have had on improved learning, despite anecdotal isolated experiences. The project continues to expand due to this deployment-driven mentality, without any pause for reflection and evaluation. The means to the end, technology delivery, has become the end goal in itself.

Communication between Divisions - The OLPC-REB, Teacher Education Management and Professionalism (TEMP), and Curriculum divisions all fall under REB. Despite being less than a 100 m from each other, there is a lack of communication. Between the divisions, there

is duplication of resources, such as visits and communications with the school, and gap in focus areas, such as edtech-integrated TPD:

> *"There is no direct relationship or partnership. Besides the fact that we are under the same roof of REB but previously we have always been a separate entity, doing everything on our own. I think that's why we have moved over to REB and there's plans for integration eventually." (OLPC-REB, Interview 18)*

The Digital Textbook - Many stakeholders, in particular OLPC-REB and the teachers, problematically equate the laptop to a digital textbook. This mentality limits the interactive and collaborative uses of the laptop:

> *"The E-solutions thing, the one that has the in-class content – it is just basically what the teacher teaches on the board, now they have it in a digital form...be it with the laptop or without the laptop, digital or text book" (OLPC-REB, Interview 18)*

Policy - There is a lack of procedure, policy and its communication. For example, if the laptops are broken or stolen, there is uncertainty as to what to do or who is responsible (Former OLPC, Interview 14). In Rwanyanza, the teachers complained that they would also like XO laptops for themselves (Teachers, Interview 8), yet it is already part of policy that the teachers receive their own laptop.

Inadequate Teacher Professional Development - Finally, the training that the teachers receive only aims to familiarise the teacher with the laptop and not familiarise them with integrating it into teaching practices. This will further be interrogated in Section 4.3.

4.3. OLPC-REB Teacher Development

OLPC-REB takes a short-term "training" approach to teacher development. To date, only "Phase One training" has been attempted, which constitutes of a five to six day initial programme given when the laptops are deployed. The "Phase Two training" focuses on integrating laptops into lessons has not commenced yet, as prioritisation has been given to first giving *all* schools "Phase One training" (OLPC-REB, Interview 17).

4.3.1. Teacher Survey Quantitative Results

The figures below represent the results from 37 grade P4 – P6 teachers surveyed. The data highlights important facts, opinions and perceptions of teachers. Results show most teachers view themselves as comfortable with the laptop, and would prefer to teach with them, even if it might be more difficult. Results from the survey showed:

- 32 out of 37 (86 %) teachers were comfortable using the laptops.
- 31 out of 37 (84 %) teachers preferred to teach with rather than without the laptop.
- 24 out of 37 (65 %) felt that using the laptop makes it easier to teach.
- 24 out of 37 (65 %) of teachers felt that using the laptops makes it easier rather than more difficult to prepare for lessons. This supports Fajebe's finding that the teachers view themselves the primary users, using the laptop to research and plan for lessons (2013).
- 35 of 37 (95 %) of teachers perceive students to like the laptops. Teachers independently used words such as "happy" (15 occurrences), "interested" (9 occurrences) and "curious" (5 occurrences) to describe the students' behaviour in lessons with the laptop. No negative words were used to describe the students' attitude in the lessons.

- 23 out of 37 (62%) of teachers thought they knew how to use laptops before training. This did not correlate to age or location.
- In Schools A and D, both urban schools in Kigali, laptop were used as much as twice a week. Schools B and C, the rural schools, have almost never used them in lessons.
- The two urban schools have had more training sessions than the rural schools. This shows a correlation between *teachers training* and *frequent use of laptops in class*.
- 18 of the 37 teachers had been working at the same school for 4 years or less, indicating high migration of teachers to different schools. 11 of the 18 teachers were over the age of 35, indicating migration of young and old teachers.

4.3.2.   Teacher Survey Qualitative Results
Likes and Dislikes
Notable responses of teachers' likes and dislikes of the laptops can be found in Table 1:

Table 1 Likes and Dislikes

Likes	Dislikes
"Help to plan activities"	*"They take more time to wait for commands"*
"They help me to find teaching aids"	*"The broken laptop when teaching"*
"To research quickly"	*"Makes me stress"*
"They have interesting games"	*"The keyboard is very small"*
"They are easy and portable"	*"Low storage capacity"*
"Making voices of different animals"	*"Difficult rules for keeping it"*
They cannot be broken/destroyed anyhow"	*"Takes much time to use them in a lesson of 40 minutes"*

Usage
Table 2 shows notable responses from the 20 teachers that stated they do use the laptops in lessons. School A teachers, in particular, expressed a wide range of uses for the laptop in the surveys. This shows that use is dependent on the teacher's preferences, rather than school.

Table 2 Usage of Laptops

Usage	Analysis
"I give each learner the machine, I control that each machine is ok, I teach by helping learners who have difficulties"	The teacher here seems to have embraced the fact that the laptops may be faulty and this is a normal part of the lesson.
"For browsing and preparing lesson"	The teacher sees himself/herself as the primary user of the laptop, and is using it for lesson preparation.
"We normally teach all according what we have gained in training of laptop"	The training given is rudimentary with no subject pedagogy. The teachers need to learn skills to create their own lessons.
"We use them according to the topic of the day"	Evidence of teacher that has been able to incorporate laptop use into curriculum.
"I use laptop according to the lesson I want to teach if it's necessary"	The teacher discerns when the laptop use is appropriate for the lesson showing agency and development of intuition.

The types of uses indicate that some teachers are experimentally using the laptop beyond their Phase One training.

Suggested Improvements

The 37 teachers were open-enddedly asked in the survey to suggest any three things to improve the program. The most recurring suggestions are shown in Table 3 and noteworthy suggestions in Table 4:

Table 3 Survey Suggestions

Suggestion	Analysis
More training (30 teachers)	Supporting the quantitative results (Section 4.3.1) that the teachers are willing to embrace the project, the teachers are explicitly asking for more training. This is because Phase One training and refresher training does not show them *how* to use the laptop in lessons.
ICT lessons to be put in the time table (15 teachers)	This shows there is a fundamental problem with the teachers' understanding of the project as the laptops are supposed to be integrated into every day lessons rather than having a separate ICT lesson. However, REB has responded to this request and there will be an ICT slot in the timetable from 2016.
Better processors in the laptop (4 teachers)	As the quantitative results (Section 4.3.1) show, many teachers have used computers before and they are thus aware of the inadequate speed and memory space.

Table 4 Noteworthy Suggestions

Suggestion	Analysis
"Improve my knowledge of teaching with the laptop", "To explain how the programme is used for learner"	Phase One training does not involve using the laptop as a tool to teach. These teachers are insightful in understanding the nuance between learning to use the laptop and teaching with the laptop. They want to learn to teach using the laptop.
"Organise training during the holidays"	Currently training happens in school time which means the students are left without teachers for the training period. TEMP already runs general training sessions during the holidays (TEMP, Interview 21). Adding on OLPC training to it will ensure that all teachers have the same level of training thus if teachers move between schools, it will not matter.
"Give us curriculum [i.e. lesson plans] about the laptop"	The teachers do not know *how* to use the laptop in lessons. They would prefer if they were told when and where to use them and how to integrate it into lessons in the curriculum (Teachers, Interview 16).

4.3.3. Analysis of Potential for Teacher Professional Development

In terms of learning needs, the teachers are requesting more training in ICT (Section 4.3.2), however they are routed in their current rote learning pedagogical practices. Differing from

the experiences in the OER4School programme in Zambia (Hennessy et al., 2015), the teachers see much potential in the students capabilities (Section 4.3.1), perhaps even more so than their own (Fajebe et al., 2013). Observations showed various accounts of students exploring further than guided by the teacher. The challenge in this case was *the teacher limiting the students' experience* due to the teacher's inexperience. There is a correlation between the amount of training the school has and the use of laptops in lessons (Section 4.3.1). This further suggests the need for TPD. The OLPC-Rwanda project holds great potential for successful TPD, as the existing framework provides a strong base. A comparison between the guidelines for implementing TPD in bold (Hennessy et al., 2015), and the potential in the OLPC-Rwanda project, based on its existing strengths, is given:

Programmes need to be long-term. A framework to introduce edtech-integrated TPD programmes exists as OLPC-REB has been running for eight years. Whilst current training is once-off, teachers are acquainted with the laptop. The idea of receiving training is accepted and in fact, requested (Section 4.3.2). This supports gradual implementation in the introduction of a continuous TPD programme.

Develop teacher agency and leadership. Whilst current training does not specifically develop teacher agency, some teachers have already been creating their own uses for the laptop experimentally (Section 4.3.2). OLPC-REB can build on this agency through empowerment in TPD programmes.

Focus on classroom implementation. Currently, classroom implementation minimally integrates edtech into subject pedagogy. Schools, however, already have laptops and having an equipped classroom is the first step to integration. Additionally, the teachers have already attempted using the laptops in lessons and can thus contribute their experiences into the TPD space.

Create opportunities for collaboration with colleagues. Weekly meetings within schools could be easy to set up, but this has not been done yet. The established OLPC-REB structure has the ability to provide a platform for collaboration between the network of teachers, which would not have been possible in a fresh project.

Draw on digital technology as a motivator for professional learning and pedagogic change. TEMP is fully supportive of adapting to interactive pedagogies (TEMP, Interview 21), but knows little about edtech. TEMP needs to collaborate with OLPC-REB as the use of edtech will help them to leverage pedagogical change (Section 4.2).

Encourage and scaffold teachers in obtaining resources. Teachers already view themselves as the primary users of the laptop, particularly for the resources they obtain through it, and they see its benefits (Fajebe et al.,2013; Section 4.3.2). An edtech-integrated TPD programme will improve their use of resources. Fortunately, there are plenty of laptops, which is a resource problem other initiatives face.

Align with teachers' existing knowledge, practice and contexts. Teachers already view themselves as the primary users of the laptop, particularly for the resources they obtain through it, and they see its benefits (Fajebe et al.,2013; Section 4.3.2). An edtech-integrated TPD programme will improve their use of resources. Fortunately, there are plenty of laptops, which is a resource problem other initiatives face.

Make space for the programme within the school timetable (and adjust policy accordingly). TEMP currently runs holiday TPD programmes. Edtech could be integrated into this, as well as weekly timetabled sessions. As compulsory ICT lessons are being built into the curriculum for 2016, this motivates for edtech-integrated TPD to take priority.

In addition to these guidelines, further guidelines are suggested from fieldwork experience:
The teacher must become the student. Until teachers experience constructivism themselves, they may not be equipped to plan and facilitate constructivist activities for their students (Alesandrini and Larson, 2002).

Develop teachers' ability to think creatively and adaptively. Allowing space for creativity empowers the teacher (Whatley, 2011). In the context of developing countries, 'unforeseen circumstances' such as power outages are a norm and the teacher needs to be empowered to respond dynamically.

Facilitate feedback, experiential exchange and peer-learning amongst teachers. Observations showed that the teachers learnt best when helping each other, asking questions and learning from their colleagues' experiences (similar to observations of the students). Talking about what is important to them, keeps them engaged. Progress can also be measured through this process.

5.   Discussion
Government initiation and prioritisation of the project are the most prominent enabling factors (Section 4.1). However, the deployment-driven mentality has caused the means to the end – providing access – to become the end goal in itself. A deployment mind-set leads to further barriers, such as funding being focused on purchasing laptops over hiring of sufficient staff capable of conducting effective professional development (Section 4.2). There were various other ways in which existing funds could be used to support educational outcomes and these alternatives were not assessed. Additionally, poor quality devices undermine the worth of teachers and students, and these are expressed in their dislikes for the hardware (Section 4.3.1). Better quality, higher value-for-money solutions are available.

The current rudimentary training offered by OLPC-REB familiarises the teacher with the laptop itself, *but does not integrate it into classroom teaching or effective teaching practices.* Teachers are *requesting professional development* and have shown agency in utilising the resources as they see value in edtech (Section 4.3.2). To explicitly incorporate interactive uses of edtech into subject pedagogy, *edtech-integrated TPD is essential.* While there are no edtech-integrated TPD programmes currently in the OLPC-Rwanda project, the project's framework provides great potential for such programmes, given that the structure and tools are already in place (Section 4.3.3). With ICT lessons officially being put into the curriculum, edtech-integrated TPD needs to be prioritised, to capitalise on the provision of edtech use across all subjects. Importantly, edtech is *a* factor in improving learning but it is by no means *the* solution. In fact, it could even have reverse implications if not utilised correctly, such as wastage of valuable lesson time during setting up. Negative implications occur due to poor management, incorrect use and unprepared teachers (Section 4.3.2).

6.   Conclusion
This research highlights that the human element is of utmost importance in edtech projects. Findings show that the most enabling factor in the intervention is the dedicated and

passionate on-the-ground OLPC-REB staff. However, their efforts are focused on deployment rather than training and improving learning. Implementation requires more than access to technology and supporting infrastructure. To improve learning outcomes, teacher support and ongoing professional development is needed. Teachers have shown a willingness to learn and are requesting training. Without developing them, both in the technical and pedagogical use of laptops, the full potential of the project will not be achieved. A shift is urgently needed from the entirely self-directed learning ideology emphasised by OLPC's constructionist learning theory, and traditional rote-learning teaching practices embedded in the Rwandan education system, to a more balanced notion of interactive pedagogy. Trainers with an understanding of subject pedagogy are needed as interactive pedagogy needs to be incorporated into curriculum teaching to maximise the use of the laptops as a learning tool. The teacher's role needs to change from being the source of knowledge, to a facilitator of knowledge acquisition. This can be achieved through edtech-integrated Teacher Professional Development.

7.   Recommendations

Many findings from the OLPC-Rwanda project may be relevant more widely. The following recommendations for effective edtech projects in general can be made:

- Technology is merely an enabler. Access to ICT does not equate to improved learning; hence focus needs to be directed towards improving educational outcomes rather than technology access. It should be used as a tool for development.
- A shift is needed away from simply training teachers, to developing them. Thus a more concerted focus is needed on TPD. This involves *teaching the teacher to teach using technology as a tool*, rather than teaching the teacher to *use technology*. Edtech should be used as a tool for improved learning across the curriculum, beyond IT applications.
- The laptop is currently seen as a digital textbook, both by teachers and trainers alike. Whilst the laptop is an efficient way of providing educational resources through digitalised curriculum content, audio, and videos, its potential is much greater. The best use of edtech is to improve learning in ways that can *only* be achieved through the use of technology, such as dynamic geometry (Power et al., 2014).
- Educational software must be specifically designed either for entirely self-directed learning, or interactive classroom learning. Applying E-solutions, which is designed for self-directed learning, into a classroom setting does not enhance the students' learning.

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EFFECT OF EDUCATIONAL VIDEO CLIP ON STUDENTS' ACADEMIC PERFORMANCE IN BASIC SCIENCE AND MATHEMATICS CONCEPTS IN JUNIOR SECONDARY SCHOOL THREE IN CROSS RIVER STATE

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Abstract

The research was to determine the effect of video clip on students' academic performance in Junior Secondary School Three in Cross River State of Nigeria. Improving on students' academic performance requires that students be provided with learning activities that could enable them create knowledge themselves to enhance retention. This article explains how video clip could be used to communicate some Mathematics and Scientific concepts. The sample of the study consisted of one hundred and sixty (160) Junior Secondary School Three (JSS3) students in Calabar Municipality. Two instruments developed by the researchers were used for the study namely: Soil Erosion Video (SEV) and Solid Geometry Video (SGV) Achievement Test and An Interest Inventory (AII). Two research questions and two null hypotheses guided the study; a non-equivalent, pre-test, post- test quasi experimental design was employed. Two intact classes were used (though not all were used as sample) from two different schools purposively sampled, one as experimental and the other, control group. The experimental group received treatment with the use of video clip, while the control group was taught conventionally. Independent t-test statistical analysis was used. The result indicated that, there was significant difference in the mean achievement scores between the control and experimental groups. This finding shows that the students taught Basic Science and Mathematics using video clip in the experimental group had higher mean achievement scores than their counterparts in the control group. Also on the interest in the classroom teaching and learning, it was observed that the experimental group had higher level of interest in concepts learnt than those in control group. These imply that knowledge can easily be gained if the students are actively involved in the classroom and their interest in the subject is aroused. The researchers recommended among others that the Government and other Education Stakeholders should encourage the use of video clip to facilitate the teaching and learning-processes in secondary schools.

Keywords*:* Video Clip, Solid Geometry, Soil Erosion in Nigeria, Interest and Academic performance.

Introduction

Mathematics and Science play vital roles in the development of Science and technology in the society. However, technological development of any nation depends on her efforts to improving on the Mathematical and scientific knowledge of her learners at all levels of education. Unfortunately, the underachievement of students in mathematics and Science at both internal and external examinations such as West African School Certificate Examination (WASCE) and National Examination Council (NECO) has been a source of worry to all

stakeholders in education and the society in general including the students themselves. The West African Examination Council (WAEC) Chief Examiner's report (2008-2014) noted with dismay that the persistent poor achievement of students in these important subjects mostly points towards the ineffectiveness of the instructional approaches used by teachers in our schools. Based on this, researchers have been making several efforts towards improving students' performance in these important subjects, among such efforts are studies on more effective instructional delivery approaches which may be activity-based innovative strategies that can motivate students to retain learnt concepts such as hands-on approach (Ekwueme, Ekon & Ezenwe-Nebife, 2015); Technological tools (Uwaezuoke & Ekwueme, 2013), among others.

Due to knowledge explosion all over the world, knowledge has been expanded from the usual practice of talk and chalk instruction from text books to a method where the students are allowed to learn via educational technology tools. These tools comprise all Video -taped instruction (VTI) which combine still and motion pictures in its pictorial presentation. Micro-soft Power point (MPP) is also computer-based tool. These tools are self-learning devices built with the help of different technologies to make teaching and learning processes more interesting and effective. Learning with VTI especially video clips used in this study could assist the students to gain proficiency in organizing their thought in the sense that the students observe and reflect on their studied materials and clarify their thought with the pictorial presentations on the clip. Agommuoh and Nzewi (2003) posited that VTI is an instructional method that has the potentials of increasing the probability that students will learn more, retain and achieve better in their academic performance. Ekon and Edem(2015) confirmed that computer-based Instructional models are effective teaching avenues which facilitate students' learning and understanding of scientific concepts .

Therefore, there is the need to use instructional strategy that could enhance their understanding and increase their creative thinking thereby enhancing their academic performance. This study therefore tries to determine the effect of the use of video- taped instruction on students' academic performance and interest in Mathematics and Basic Science.

Literature Review

Some research work had shown improved students' academic achievement and interest due to computer- based instruction. For instance, a study by Ekon and Edem (2015) on the effects of computer-based constructivist instruction on students' achievement and interest in Biology revealed a significant difference between interest score of students taught using computer-based constructivist approach and those taught with constructivist model of instruction. In another study by Ugwu and Nzewi (2015) on the effects of two instructional delivery approaches on Senior Secondary Schools students' achievement in Biology revealed a significant difference in favor of the students taught using Video Tape Instruction (VTI). Wonu and Didi (2010) investigated the effectiveness of computer Assisted Instruction (CAI) in teaching Statistical Measure of Location (SML) at senior Secondary Class 3 (SS3). The study revealed that the use of CAI as a back-up strategy in teaching SML was significantly effective. Wonu and Domaka (2013) study on the use of Microsoft Mathtool (MSMT)in teaching quadratic equation in a Mathematics classroom revealed that Computer Assisted Instruction CAI was significantly effective as compared to the conventional method. Another study by Lawson (2006) suggested that students retain more factual information when they

see videos compared to when they read only the text books. Furthermore, Ifte, (2011) investigated a study on the effect of video clips on students' performance in a construction Science course at an undergraduate level and discovered that watching video clips has a statistically significant effect on students' performance. It has been shown generally from literature, that watching video clips provide opportunities for the learner to use maximum senses to get information. There is paucity of literature on the effects of educational clips used in communicating Mathematics and Science concepts in secondary schools in Nigeria; therefore it is worthwhile to see how video clips could be used to communicate Mathematics and Scientific concepts in JSS3 in Cross River State of Nigeria.

Research Questions

1. To what extent does the use of video clip affect students' academic performance in Basic Science and Mathematics?
2. How does video clip affect students' interest in classroom teaching and learning?

Hypotheses

1. There is no significant difference in the mean score of students' taught using video clip and those taught using conventional method.
2. There is no significant difference in the mean interest score of students' taught using video clip and those taught using conventional method.

Theoretical Framework

To provide the theoretical basis of this study, Bandura's social learning theory was considered which was propounded in the year 1977. Bandura (1997) posited that learning is a cognitive process which takes place in a social context and can occur purely through observation and imitation. Albert Bandura's social cognitive theory is a type of learning theory assumed by way of observation through which an organism watches and observes other organisms. In this regard, human beings form the habit of observing one another and imitate a behavior most appropriate and convenient to him. Learning can therefore, be carried out by observation and imitation as noted by Ugwu and Nzewi, 2015. By implication, learning occurs by watching the events of the environment which may occur physically or derivative of the real objects. By such learning, humans are seen as social animals that through observations and interpretations could collect information through which skilled performance are learnt. The social learning theory has useful application in learning such as computerized instructional approaches where pictorial presentations of learning materials are featured. This implies that students could learn by watching the video clip and imitate the actions if given the opportunity by so doing will be able to grab and retain learnt concept easily.

Methodology

Quasi-experimental design was used for this study. The experimental and control groups were purposively assigned to two intact classes. This study was conducted in Calabar Municipality of Cross River State of Nigeria due to possible availability of facilities for the experiment. A sample of 160 JSS 3 (80 for control and 80 for experimental group) was randomly assigned to either control or experimental group from a population of about 3,790 students. The researchers sensitized the experimental group teachers on the use of the video

clip to teach soil erosion and solid geometry. The researchers provided among other things, the video machine, remote control and disc for the lesson to be taught by the subject teachers to avoid Hawthorne effect. Two instruments namely: Erosion -Geometry Video Achievement Test (EGVAT) and An interest inventory (AII) developed by the researchers were used for the study. A 20- test items for EGVAT and 10 interest statements for AII were constructed and presented to two experts in Measurement and Evaluation in Faculty of Education, University of Calabar, Calabar for the purpose of face validation. The comments and recommendations of these experts helped in modifying the instruments. A reliability coefficient of 0.75 and 0.87 were established using Pearson Product Moment Correlation and Cronbach Alpha on 20 students used for pilot testing of the instruments (EGVAT and AII) respectively. These showed that the instruments exhibited adequate reliability for use in the study. The two groups, experimental and control were pre-tested before teaching the lesson. The experimental group had the mean score of 12.8, while the control group had the mean score of 12.1. The pre-test result showed that there was not much mean difference between the two groups. The control group students were taught using the conventional method, while the experimental group students were taught using the video clip produced by the researchers. After the lesson, this same test was given to the two groups as post-test. The interest inventory was also given to the students in the two groups. The test instrument was administered to the students first as pre-test, after which the subject teacher guided the students to perform some tasks during the lesson. During such tasks, the teacher pressed the pause button in the remote and allows them to perform such activities and then continues with the lesson. After the teaching, the post test was administered to the two groups and the researchers collected and recorded the scores for data analysis. The research questions were answered using the mean and standard deviation while the research hypotheses were tested using independent t-test analysis at 0.05 significant levels.

Result

Research Question 1: To what extent does the use of video clip affect students' academic performance in Science and Mathematics?

The mean and standard deviation of the experimental and control group achievement in Mathematics and Science.

Table 1 Mean and Standard deviation of the Experimental and Control Group students' performance in Basic Science test.

Variable	N	X	S.D	Mean Diff
Experimental Group	80	38.67	20.2	
				20.4
Control Group	80	18.30	19.3	

From Table 1, the data on students' mean difference in Basic Science revealed that the mean scores of students in the experimental group, taught with video clip was 38.7 with the standard deviation of 20.2 while those taught with conventional method had 18.3 with

standard deviation of 19.3. Therefore, the students taught with Science video clip performed better than those taught with conventional method with mean difference of 20.4.

The mean and standard deviation of the experimental and control group achievement in Mathematics and Basic Science.

Table 2 Mean and Standard deviation of the Experimental and Control Group students' performance in Mathematics test

Variable	N	X	S.D	Mean Diff
Experimental Group	80	18.18	4.95	
				7.35
Control Group	80	10.83	5.43	

From Table 2, the data on students' mean difference in achievement revealed that the mean scores of students taught with video clip was 18.18 with the standard deviation of 4.95 while those taught with conventional method had 10.83 with standard deviation of 5.43. Therefore, the students taught with Mathematics video clip performed better than those taught with conventional method with mean difference of 7.35.

Research Question 2: How does educational video clip affect students' interest in the classroom teaching and learning?

Mean and standard deviation of the interest scores of students taught using video clip and students taught using conventional method.

Table 3 Mean and standard deviation of the interest scores of students taught using video clip and students taught using conventional method

Variable	N	X	S.D	Mean Diff
Experimental Group	80	12.7	11.6	
				4.28
Control Group	80	8.42	9.65	

Table 3 showed that students taught using video clip had mean interest of 12.7 with standard deviation of 11.6 while the students taught using conventional method had the mean score of 8.42 and standard deviation of 9.65. This shows that students taught using video clip had higher interest than their counterparts.

H01: There is no significant difference in the mean score of students' taught using video clip and those taught using conventional method.

Table 4 Independent t-test analysis of the difference in mean performance between the experimental and control groups in Science test.

Variable	N	X	S.D	df	t-cal	t-cri
Experimental Group	80	38.67	20.2			
				158	29.1	0.364
Control Group	80	18.30	19.3			

From Table 4: The students in experimental groups had a mean score of 38.67 while their counterparts in control group had a mean score of 18.30. The result of the t-test analysis of the mean in table 4 showed that the calculated t-value of 29.1 was greater than the critical t-value of 0.368 at 0.05 level of significant with 158 degree of freedom. The null hypothesis was rejected implying that there is a significant difference in the mean score of students' taught using video clip and those taught using conventional method. This implies that the group taught using video clip performed better than their counterparts taught using conventional method.

Table 5 Independent t-test analysis of the difference in mean performance between the experimental and control groups in Mathematics test

Variable	N	X	S.D	df	t-cal	t-cri
Experimental Group	80	18.18	4.95			
				158	20.4	0.364
Control Group	80	10.83	5.43			

From Table 5: The students in experimental groups had a mean score of 18.18 while their counterparts in control group had a mean score of 10.83. The result of the t-test analysis of the mean in table 5 showed that the calculated t-value of 20.4 was greater than the critical t-value of 0.364 at 0.05 level of significant with 158 degree of freedom. The null hypothesis was rejected implying that there is a significant difference in the mean score of students' taught using video clip and those taught using conventional method. This implies that the group taught using video clip performed better than their counterparts taught using conventional method.

Ho2: There is no significant difference in the mean interest score of students' taught using video clip and those taught using conventional method.

Table 6 Independent t- test analysis of the difference in interest between students taught using Mathematics and Science video clip instruction and those taught using conventional method

Variable	N	X	S.D	df	t-cal	t-cri
Interest score of experimental group students	80	12.7	11.6			
				158	2.36	0.364
Interest score of Control group students	80	8.42	9.65			

From Table 6: Results of the analysis in Table 6 showed that students in experimental group got higher interest mean score of 12.7and their counterparts in control group, had mean score of 8.42. This shows that the experimental group developed higher level of interest in Mathematics and Science than those in control group. However, when the mean scores of the groups were statistically compared using the t-test statistics, it was found that there were significant difference between the groups since the calculated-value of 2.36 was higher than the critical t-value of 0.364. Therefore, the null hypothesis was rejected which indicated that

there was significant difference in interest between the two groups. The higher standard deviation of scores (S.D 11.6) obtained by the experimental group indicated that their individual scores spread more from the mean than those of the control group (S.D 9.65).

Discussion

The result gotten from this study shows that the use of video clip significantly influenced students' performance in Mathematics and Basic Science. The students taught with video clip achieved more than their counterparts taught without the video clip. This shows that the instrument used helped the students to observe and study the materials presented to them which also classified their thought with the pictorial presentation. This agreed with Albert Bandura's social cognitive theory who suggested that learning takes place through observation and imitation. From the interest inventory, it was discovered that there was enhanced interest shown on the use of video clip on the students. They agreed that the use of video clip promotes meaningful learning of Mathematics concepts and Basic Science., especially the natural video scenario   displayed in Basic Science clip.

Conclusion and Recommendations

The result from this study showed that students' taught using video clip achieved significantly better and showed greater interest in the lesson than their counterparts taught with conventional method. It was also discovered that many students who had not been attending Basic Science and Mathematics lessons, suddenly developed interest in these subjects after watching the video clips. The greater difference in performance could be as a result of the opportunity given to the experimental students for application of both visual and pictorial presentation. Since the use of video clip was found to enhance achievement and interest in Mathematics and Sciences, teachers should employ the use of video clips in the teaching and learning processes. It therefore means that, State, Federal Government and concerned stakeholders should procure enough computers for all secondary schools for the teachers and the students to make good use of. Again, teachers in secondary schools should be re-trained periodically in order to create awareness on the efficacy of video clips in teaching and learning processes.

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ENHANCING LEARNING THROUGH TECHNOLOGY: IS THERE SOMETHING NEW?

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Abstract

In higher education, technology enhanced learning (TEL) has become inevitable and it is apparent that the use of technology in higher education has risen in the last decade. Although there has been much academic discourse on the use of technology to enhance learning in the recent past, the relationship between education and technology has a long history dating back to the 'Skinner box' and 'Pavlovian theory'. It is therefore the aim of this paper to argue that there is nothing new in the use of technology in teaching and learning and that indeed its use should become widespread across systems and more fully implemented in teaching and learning. This paper seeks to conceptualise the trajectory in the use of technology in enhancing learning in higher education through the use of a number of theoretical frameworks as lenses through which this study is perceived. The study considers a number of theories with constructivism being the main theory. Different literature sources were reviewed on the topic leading to the conclusion that technology is not really an innovation but has always been available in one form or another. In conclusion, we posit that technology has been used to enhance teaching and learning from time immemorial when technology had not yet been computerised to the 21st century.

Keywords: Technology enhanced learning, higher education, innovation

Introduction

The term technology enhanced learning (TEL) refers to the use of technology to support teaching and learning. Although some scholars underpin the use of technology to e-learning only, which was popularised by the invention of computer technology, this study looks at the use of technology that enhances teaching and learning not only from this angle. This paper follows the argument by Stuparich (2001) and Catherall (2005) who contend that TEL is the delivery of an interactive learning environment to students without the constraints of time or geography. The interactivity to which both Stuparich (2001) and Catherall (2005) refer is not limited to computer technology, including e-learning or online learning only, but also to any other technology that may be used in the learning environment to enhance learning. Most frequently, TEL is considered synonymous with equipment and infrastructure (Kirkwood & Price, 2013). This means that TEL represents the technological support of any pedagogical approach, for instance, a toy that teaches babies to utter their first words or a video game that improves logical skills; learning how to play the piano using an iPad (Porta et al., 2012). Emerging from this notion, as is also noted by Roffe (2004), the use of technology to enhance learning is not a new concept. Roffe (2004) further indicates that long before the provision of learning by the Web, technology enriched the educational experience of learners. According to Tchounikine, Morch and Bannon (2009), TEL is a research arena where different disciplines such as computer science, education, philosophy, pedagogy and communication intersect.

In this paper, we bring together educational research and the sociology of knowledge to provide an analysis of the current state of TEL. The purpose of this paper is to trace through the relevant literature the use of technology to enhance learning and teaching from the times of the forerunners of behavioural theorists, for example the Russian physiologist, Ivan Pavlov (1849-1936), the American psychologists Edward Thorndike (1874-1949) and BF Skinner (1904-1990), to its current use in educational practice. Lastly, there is a summary of the various literature reviewed.

As acknowledged by Specht and Klemke (2013), we are living in a technology-enhanced world. Moreover, learning is affected by recent, upcoming, and foreseen technological changes. One also observes that globally, technology has become increasingly interconnected with our everyday lives; the 21st-century generation, organisations and schools are all becoming more dependent on diverse forms of technology. Access to the Internet in this millennium is simpler, for example it can be made from one's home, an affordable internet café in most places, or even on some smart phones. The use social media has surged globally in recent years (Guy, 2012). Most of the SM used frequently by students include among others, Twitter, Mix-it, Facebook and Google+. Students that identify themselves with these kinds of technologies would be better equipped for the workplace than those without this exposure. A number of researchers (Junco, Elavsky & Heiberger, 2012; Junco, Heiberger & Loken, 2011; Yu, Tian, Vogel & Kwok, 2010) do not overemphasise the importance of technology in higher education institutions (HEIs) by pointing out that present-day university students are fully at ease with technology. Indeed technologies that are used to support learning and teaching are quickly becoming an important way of life in the ever-changing climate of higher education provision.

Epistemological Foundation of TEL

Just like any other learning and teaching approach, TEL is also based on a theory. This enquiry is based on the foundational theory of constructivism from which other supporting theories emanate (Jonassen, 1994). Constructivism is the psychological theory emanating from Piaget, Vygotsky and others, which proposes that humans construct their own knowledge, intelligence and morality through a series of stages and often in collaboration with others (French, 2007). This means that constructivism is reinforced by cognitive, behaviourist, social and adult learning theories. These may not be the only theories reinforcing constructivism, but this paper focuses on these four. It is worth noting that technology can be used to augment the curriculum by allowing for the construction of knowledge, problem solving and integration of new experiences with previous learning experiences (Rice & Wilson, 1999). Constructivism in this case is seen as an umbrella theory relevant for the millennial students and on which many other learning theories are based. This network of theories is more like an Eiffel Tower with legs but all meet at the top point, which, in this case, is constructivist theory. Roffe (2004) claims that these theories form the basis of the exploration of TEL. The choice of delivery and learning methods should be driven by a coherent and conscious perception of how people learn, as a result bringing value in considering how people learn using these theories.

Constructivism as the main theory underpinning the study

Constructivism is a pillar of this study due to its emphasis on the students' learning autonomously; it encourages a student to use initiative and construct his/her own meaning and understanding (Steffe & Gale, 1995). This study also advocates the ability of students to construct knowledge themselves and fit information together in such a way that what they already know is allowed to take precedence (Fosnot, 1996) (reference). Although Sjoberg (2007) advises that the term constructivism be used with great caution because of its multifaceted nature which may lead to its wrong use, the authors come to the same understanding of the concept 'constructivism', which is students constructing meaning based on the new knowledge they gain though the manipulation of their environment. The primary aim of this theory is to engage e-students to construct meaning and acquire knowledge based upon their own perceptions of experiences (Bush, 2006). Roffe (2004) emphasises that in constructivism, the engagement of students is perceived as an essential element of learning, which gives space for a shift from what the teacher may do to what the learner does as an active agent in making sense of the learning process. In TEL, students are presented with a learning environment that allows them to reflect on their own experiences and manipulate the environment to come up with their own understanding of the world in which they live hence they can be classified as active agents rather than passive students. Constructivist theory advocates that students learn best when they are given an opportunity to construct meaning on their own, in an environment conducive to learning (Loyens & Gijbels, 2008).

Biggs and Tang (2011) add to the perception that constructivism is a tool used by teachers to engage students in their teaching process for students to build on their existing experience and knowledge. Students with constructive minds interact with objects and events and thereby gain understanding of the features held by such objects and events. TEL students learn independently from the teacher, and engage intellectually with the content (Ridge & Waghid, 2000). It is from this point of view that we harness TEL to constructivism as a learning theory. Constructivism is not merely about constructing meaning and new knowledge; it also has a social dimension because meaning is constructed in a social context and communicated dialogically through socially negotiated understanding (Ridge & Waghid, 2000). What is of paramount important is that in constructivism learning occurs as an inner process that affects the entire personality (Roffe, 2004).

Social Learning Theory and TEL

Communications technologies that mediate the communication process in higher education create social climates which are very different from those of the traditional classroom. For learning to take place, students should actively interact with each other and with the instructor to arrive at shared meaning and to make sense of what they are learning (Berge, 1999). The social interaction of students started around 1997 when social network sites such as SixDegree, Classmates.com and later, Facebook, were developed (Boyd & Ellison, 2007).

Social learning, according to Tu (2000), requires cognitive and environmental determinants; this implies that in social learning theory, the extrinsic motivation or environmental stimuli drive people as isolated influences. For instance, when we look at e-learning, the e-students rely more on the e-environment, for example internet connectivity and this environment

stimulates them to learn. The social learning theory explains human behaviour in terms of a continuous reciprocal interaction between cognitive, behavioural and environmental determinants; all these operate as interlocking determinants of each other. Tu (2000) further suggests that in social learning theory change of behaviours results from interacting with other people and their environments, hence Checkel (2001) emphasises social learning as a process whereby people's interests and identities are shaped through and during interaction. This interaction is referred to as social interaction.

Social interaction is the key to explain how social presence affects social learning Akers & Sellers, 2004). Social interaction between learners and online role models is required for social learning to occur. Students regard those whom they deem intelligent and their facilitators as role models and follow in their footsteps. Students collaborate and interact with them online with the result that if there is no interaction there is no learning (Tu, 2000). This author sees social presence as a dynamic variable, which makes online social learning more complicated and it needs to be scrutinised from a social presence aspect. Students must acknowledge and value the other person's online social presence, if not so, there would not be social interaction and collaboration, resulting in the absence of social learning. The student must be presented with an enhanced social presence to create an environment for social learning (Tu, 2000). Students who become familiar with this social learning environment develop better cognitively than a student who depends on the teacher.

Cognitive Development and TEL

Biggs and Tang (2011) see constructivism as having a long history in cognitive psychology, dating back to Piaget's era. Piaget and Bruner, though they lived in the past, could foresee how education would transform itself. Bentham (2002) presents Piaget and Bruner as advocating the view that knowledge should be constructed and that they regarded students as active in their quest for knowledge, which gave birth to a concept of discovery learning which sits well with constructivism. Bentham (2002) further stipulates that cognitive development theorists argue that the manipulation of the environment is related to the individual's level of maturity and experience. If a student is sufficiently mature to take charge of his/her own learning, the student is able to manipulate the environment for learning purposes and develop new meanings, derived from experience gained throughout earlier years of learning.

Piaget (1977) believed that the individual operating at this level should be in the last stage of cognitive development, which is formal operational, whereby an individual is engaged in abstract thinking. If there has been no delay in the cognitive development of a student, an HEI student should be operating as per the age allocation of this stage (11–12+). Although there has been much debate and criticism around Piaget's formal operational stage, scholars such as Keating (1980 cited by Bentham, 2002), believe that Piaget overrated the thinking capacity of children aged 11–12 years. Furthermore, she supports Papalia (1972) and Rubin et al. (1973) when they state that 50 to 60 per cent of people 18 or even 20 years old use the formal operations while some adults are unable to operate at this level. The arguments presented by the scholars mentioned by Bentham (2002) are important, even though the instances occur in exceptional cases. What increases their validity is the technology that forces these students to be inquirers after knowledge rather than passive recipients.

Scholars might have had a point in the past, but this has changed tremendously with the introduction of technology. The younger generation, of the age Piaget mentions in his formal operational stage, can access whatever information they require from the Internet at any time and as they wish. The current generation, who might be referred to as the 'techno-generation' whose lives are more centred on technology and thus can operate almost every technological gadget, can think and create their own meaning using information they have searched for themselves. The techno-generation can be given any technological environment and they will manipulate it to their benefit; such student is not limited by time and space. A TEL environment offers students the opportunity to assess and manipulate their environment; it gives them a good space to construct their own meaning, and thus learning takes place effectively (Vygotsky, 1978). In other words, behaviour is as a result of stimulus and response, whereby students respond to a stimulus by manipulating and working through their environment to achieve the desired goal.

Such behaviour is learnt from the environment. This notion comes from the observation that some theorists believe that there is little difference between the learning that takes place in humans and that in animals. Skinner (1948) and Thorndike (1874-1949) also used animals to discover whether or not behaviour is learnt from the environment. The best way to understand behaviour is to look at the cause of an action and its consequences.

Behaviourism Theory and TEL

Behaviourism theory is one of the legs of the Eiffel Tower as suggested at the beginning of this section. It is based on the ideologies of empiricists who believe that learning occurs as a result of experiences (Bednar, Cunningham, Duffy, Perry, 1995). This position, according to Ertmer and Newby (2008), implies that people are born blank and that whatever they have learnt, was through association and interaction of the environment, where they gain knowledge. They summarise this thought by postulating that knowledge is derived from sensory impressions that produce complex ideas when closely related in time and space.

The behaviourism theory is birthed upon the foundations of the above discussed philosophy by John Watson, formulated in 1913. The theory was popularised by BF Skinner in 1930s. Behaviourism is Skinner's philosophy of the science of behaviour and Bélisle (2008) explains that it is based on the psychological stimulus-response (S-R) paradigm. Ertmer and Newby (2008) equate behaviourism with learning, declaring that learning is accomplished when a proper response is demonstrated following the presentation of specific environmental stimuli.

The e-environment stimulates e-students to manipulate the environment and in the process to learn. The process followed to manipulate the environment is irrelevant; what is significant is the learning process the student goes through. Hence Ertmer and Newby (2008) argue that behaviourism theorists focus mainly on the importance of the consequences of those performances and contend that responses that are followed by reinforcement are more likely to recur in the future. The recurrence of reinforced behaviour brings lasting change to one's behaviour in response to environmental and contextual stimuli (Bélisle, 2008).

In an asynchronous environment a student may repeat a certain action stimulated by the environment and the pleasure derived from playing with the technology. The more the student plays with technology, repeating what he/she is doing, the more she/he learns. Learning happens when student behaviour is shaped by reacting to situations that encourage actions that gradually conform to a fixed goal. TEL allows drilling and practising, and also gives leeway for a greater individuation of the whole process (Bélisle, 2008). The change on a TEL student is strongly visible and students would not only gain knowledge of a specific discipline but also acquire technological skills.

Knitting the theories together, it appears that learning in a TEL environment is an active process in which meaning is developed on the basis of experience and manipulation of the learning environment. Conceptual growth comes from the negotiation of meaning, the sharing of multiple perspectives and the changing of our internal representations through collaborative learning. Learning should be situated in realistic settings; likewise, testing should be integrated with the task and not a separate activity. Consequently, learning is seen as a personal interpretation of the world. In the case of TEL, students are given a learning environment that is resourced and they are required to search, understand and construct their own meaning of concepts. They do not rely on given meaning, but through hands-on experiences and manipulation of their environment, students will derive their own meaning and understanding.

Trajectory of the Use of Technology in Learning and Teaching

Klopfer et al. (2009) recognise that technology can have a reciprocal relationship with learning and teaching from previous years. From the earliest times learning and teaching have always been delivered by a variety of methods and students have always employed a variety of modes of learning, including informal modes such as discussing subject material with other students. Technology has played a pivotal role in education, especially in enhancing the understanding of a course of study. The importance of this technology in education has given rise to dialogue amongst scholars in the specific field, especially in this millennium (Hall & Winn, 2010). This does not mean that the relationship between technology and education started recently; by contrast, it has a history dating back to the Skinner box and Pavlovian theory.

The above discussion affirms Lepi (2012) who indicates that "education and technology have come a long way over the past generation". Technology has been used throughout the years, and what makes it unique over the ages is that it has markedly evolved. Nowadays students of their own volition discuss aspects of the curriculum using social networks (SN) such as Facebook and Twitter (Olivier, 2011). TEL has become increasingly used amongst the techno-generation and students learn through fun. In 2004, Donald et al. (2004) predicted that Information Technology would spearhead improvements in higher education. The process of learning and teaching is an art and a creative experience, and we need to enjoy and behold it. It is important to appreciate that our teaching is related to those whom we reach and also depends on who we are. The medium we use to reach our audience or students should be able to attract them and get them absorbed in what we teach for learning to take place (Williams & Merten, 2009). It is patently obvious that our youth and children (students) are

fascinated by technology and spend a considerable amount of time on the Internet using either a laptop/PC or a smart phone for access.

Where it started

During the 20th century, technologies such as instructional films, radio and television, Sidney Pressey's teaching machine in the 1920s, programmed instruction, audio and video cassettes, and the microcomputer were used to enhance learning (Westera, 2010). Although behaviourists, for example Ivan Pavlov (1874-1947), Thorndike (1874-1949), and BF Skinner (1954), used animals for their experiments, they unanimously believed that the same activities would be applicable to the human race. What these psychologists emphasised is that learning occurs through developing associations between the events and consequences of our behaviour informed by our interaction with the environment.

If the same computerised equipment available today were present in their day, they could have used it to illustrate the fact that learning takes place when people manipulate their environment. In the TEL environment, students are afforded the opportunity to manipulate and acquaint themselves with their own environment. As students explore their environment, learning takes place. Pavlov (1849-1936), Thorndike (1874-1949) and Skinner (1938, 1953) used different technologies to convey the message, yet their philosophies were the same.

Pavlov (1849-1936) discovered classical conditioning, which is a learning process that occurs through associations between an environmental stimulus and a naturally occurring stimulus. Pavlov (1849-1936) used a bell as his tool to stimulate learning. He rang the bell every time he presented food to his dogs. This author repeated this exercise over and over, then at a time he just rang the bell without presentation of food but the dog still salivated. This response indicates that the dog had learnt to associate the bell and the food; a new behaviour had been learnt (McLeod, 2007). The Pavlovian study was followed by operant conditioning started by Thorndike (1874-1949) after which Skinner (1904-1990) took it forward. Thorndike (1874-1949) used a technology called Thorndike's puzzle box that Skinner (1954) named his Skinner box. These two psychologists believe that students do not passively absorb knowledge from the world around them but that they play an active role in learning. Students learn by doing, experiencing, and engaging in trial and error, which is one of the characteristics of the self-directed TEL students (McLeod, 2007).

The difference between the two learning media of learning, namely classical and operant conditioning is that classical conditioning depends on developing associations between events while operant conditioning involves learning from the consequences of one's behaviour. One thing that the experimenters of the media have in common is that they all use technology to demonstrate how learning takes place and the change in behaviour that learning brings (Kanwar, 2008; McLeod, 2007).

TEL in the millennium

Since the beginning of the 21st century, a number of studies have been published on technology and education. Scholars in the field have focused their attention more on the impact of technology in education than on other areas, recognising that if technology is used

inappropriately it will not yield the desired outcomes with regard to teaching and learning. For example, Klopfer et al. (2009) state that the rise of new technologies compels educators to understand and leverage these technologies for classroom use but at the same time, the on-the-ground implementation of these technologies in the classroom can directly impact how these technologies continue to take shape. However, the rise of technology, especially with the move from analogue to digital, requires the users in educational sectors to be retooled and re-skilled (Bitter & Legacy, 2008).

There are several technologies that can be used to enhance learning, which include the learning management system (LMS), audio visual systems, instructor-led group, social mobile learning and social media. When e-learning or the TEL concept is mentioned, most people think first of LMS, which is not the only component of TEL, especially in the 21st century. These technologies will be discussed in this section. The origin of LMS dates back to the 20th century when the use of the Internet gained popularity in distance education and created a massive revolution in learning. Some of the advantages of internet use in distance learning are that it made collaboration in learning possible because teachers or lecturers could send material to students promptly. The development of LMS can be attributed to the successful use of the Internet in distance education (Cheng et al. 2010). Since the move towards TEL, the various HEIs have adopted different LMSs to enhance teaching and learning. Cheng et al. (2010) define LMS as web-based software purely designed and developed to support the teaching and learning process in all educational environments and used to plan, deliver and manage learning events within institutions of learning and teaching. LMS can be used both synchronously and asynchronously, depending on the requirements of the teacher or instructor and the demands of the learning programme.

According to Cheng et al. (2010), Shelly, Cashman, Gunter & Gunter (2008), mobile learning (m-learning) is a learning and teaching strategy that has become popular and uses mobile devices that can be carried around, such as mobile smart phones, tablets, laptops, personal digital assistant (PDA), iPods and any other wireless mobile technologies. Such devices can connect to social networks such as Dropbox, Google, Facebook, Twitter, MySpace, and other internet-based technologies (Shelly et al., 2008). This has become possible because these devices have become more powerful, networking standards have improved and the ability to provide internet content to mobiles has increased. Mobile devices are relatively cheap and the invention of such is growing at a phenomenal rate. In this era, the Internet is also easily accessible to most smart phones at a cheaper rate than its alternatives (Shirky, 2010). In some areas where Wi-Fi is available, a device with Wi-Fi connectivity has internet access free of charge. As a result, learning is ubiquitous and can be accessed at any time on such devices (e-Compete Wales, 2004). This is echoed by Cheng et al. (2010) who suggest that although mobile learning is still a research challenge, in future m-learning will allow students from anywhere around the globe to collaborate with anyone at any time. As of July 2011, Facebook passed 750 million users, LinkedIn had over 100 million members, Twitter had over 177 million tweets per day, and YouTube reached three billion views per day (Chen & Bryer, 2012). Mobile phones can be used to provide administrative support by sending SMS texts to remind students of important dates, such as contact classes and examination registration. In addition, they can also send messages of academic support, which would motivate students on a continual basis (Kanwar, 2008).

Wilson, Gosling and Graham (2012) noted that during the last few years some SM sites have received massive scholarly attention. SM, according to Schejter and Torish (2012), is a communication technology that enables the maintenance of the links between individuals and the personal and cultural networks to which they wish to belong. In SM, users share common space and common interests to share or promote ideas, experiences, and insights as well as simply to talk and connect with others, if for no other reason than to make a new friend or just have someone with whom to converse (Solis, 2008). SM can be a powerful learning environment for HEI students. The SM natives would encounter no difficulties in using the environment and derive enjoyment from it because they are used to it. They like to live, work and play in digital settings and interact with each other through common websites and specialised areas within those websites, such as chat rooms, discussion groups, news groups, etc. for the purpose of sharing, gaining, propagating and discussing all manner of topics (Gonzales, 2009; Lenhart et al., 2010; Shelly et al., 2008).

Future of TEL

Bitter and Legacy (2008) emphasise that technology will continue to play a major role in our future and these advances constantly offer challenges to learning and teaching developments. On the basis that what was science fiction 10 years back is reality today and will be obsolete in 10 years' time, these authors find it difficult to distinguish between present and future.

Technology is not static, since the inception of computers in the late 1930s it has changed with time to this era (Tomei, 2008). In a more general sense, technology has evolved with time but in the main it has been used to enhance teaching and learning (Lee, Yoon & Lee, 2009). Looking at the speed the technology changes and how it changes, it makes it difficult to predict the future of its use in education. All that is evident and can be foretold is that TEL is gradually moving towards ubiquitous learning, which means that learning is happening at anytime and anywhere (Britland, 2013). This view is as a result of the introduction of mobile technologies that can be used for learning purposes such as palm-size computers.

Britland (2013) believes that iPads and other mobile technologies are the now, but there might be newer technologies for future learning. This author does not rule out the possibility of tablets being part of the technologies used for learning and teaching in future. Britland (2013) portrays the future being about access, anywhere learning and collaboration, both locally and globally, of which we see the signs today. He further states that teaching as indicated in the theoretical framework will be social. TEL technologies are perceived as the only way to efficiently address the huge increase in learning needs and numbers because of their distributed and flexible potential.

Changing the Higher Education Landscape

It is evident from the literature referred to in the above section that the landscape in HEIs has seen dramatic changes. TEL has evolved from its origin of manual operation to its present computerised complex state (Prokopenko & Baksheeva, 2008; Britland, 2013). The use of TEL helps students to take charge of their own learning; they may not as easily forget what they have learnt, thereby ruling out the possibility of learning being surface deep. Taking note

of the increased use of technology, Biggs and Tang (2011:3) predicted that HEIs would continue to experience drastic change, not only attributed to high participation rates and diversity in student population, but also to other factors, which have altered the main mission of higher education and modes of delivery; the use of TEL is one of these factors.

Biggs & Tang (2011) describe the rate at which the higher education landscape would change as "hectic". The growth in the use of technology and the invention of computerised devices, clearly suggest that the techno-generation is more than familiar with visual environments and that they prize social networks. This is the reason why HEIs should move practices from the traditional to those that are passionately attached to online learning and teaching (Tomei, 2008). Although most educational institutions are still organized to produce citizens who will fit into an industrial era, the mode of delivery of programmes should become even more dynamic, flexible and responsive to the demands of particular enterprises and sectors.

Ellis and Goodyear (2010) recognise that students now have a wider range of places where they can study and learn because of the increasing availability and accessibility of Information and Communication Technology (ICT), which has created greater flexibility in educational provisioning. Boughey (2000) takes this further and argues that changes in HEIs mean that the lecturing and teaching methods that have been used there for many decades are no longer relevant. This development calls for a change in the way the curriculum is presented across higher education. Teaching has moved from revolving around the lecturer and the syllabus and now centres on the student and outcomes.

Conclusion

TEL in higher education has become inevitable and the use of such technologies has risen in this area. The aim of this article was to argue whether the use of technology in teaching and learning is indeed an innovative stride or one of the systems that has been in existence for some time but that needs to be implemented in teaching and learning. In this article, we argued that although there has been extensive academic discourse on the use of technology to enhance learning recently, the relationship between education and technology has a history dating back to the Skinner box (1954, 1968) and Pavlovian theory. The trajectory in the use of technology in enhancing learning in higher education was conceptualised. The article has considered a number of theoretical frameworks as lenses through which this study is perceived, with constructivism being the main theory. Different literature sources were reviewed concerning the study, leading to the argument as to whether TEL is an innovation or has been part of the educational scenario for decades.

In conclusion, this paper contends that learning and teaching have been delivered to students through technology from time immemorial when technology was not yet computerised to the demands of the 21st century (Prokopenko & Baksheeva, 2008; Britland, 2013). The various technologies of different ages have enabled learners to construct their own understanding of concepts as they also work in social communities of learning; yet the principles of these technologies are the same. Hence there is nothing new about enhancing learning with technology; only the technologies themselves have changed, and will continue to change, over time. Undoubtedly TEL technology is the future and the only way to address the learning needs in different societies.

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ADEQUATE USE OF EMERGING MODERN METHODS OF TEACHING OFFICE TECHNOLOGY AND MANAGEMENT IN NIGERIA

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Abstract
This paper examines the awareness, understanding and use of emerging methods of teaching Office Technology and Management (OTM) in Ogun State, Nigeria. Population of the study comprises 45 OTM Lecturers in Ogun State Higher Institutions of learning. Questionnaire was the instrument used for the research work after it was pilot tested to measure reliability using Cronbach Alpha Coefficient formula, the Alpha analysis yielded a reliability coefficient of .90. It was found that these methods of teaching are effective but not used by lecturers because of lack of theoretical and practical knowledge, as well as conducive environment for their use. The researchers therefore recommended that these methods and any other new methods should be included in the Curriculum of OTM Teacher Education, existing lecturers should be trained and the environment should also be conducive for upgrading teaching methods as they advance daily.

Keywords: Awareness, Understanding, Adequate, Modern Methods of Teaching, Office Technology and Management.

Introduction
Office Technology and Management (OTM) is a new long awaited ICT-driven curriculum aimed at producing graduates who would be able to effectively manage the electronic driven office and who would be equipped with secretarial and office skills for employment in various fields of endeavour. Office Technology is the application of scientific knowledge, devices and systems to facilitate and enhance the process and delivery of the same.

Secretarial/Office Technology and Management has changed in the past three decades. Although, change is a normal phenomenon in life but the change in this area of specialization is almost on daily basis. Technology is advancing each day as sophisticated Office Technology and Management like Computers, Word Processors, Shredders, Photocopiers, Laminating Machines, Spiral Binding Machines, Telephone, etc. coupled with new management techniques have completely changed old work practice in the office. These also led to need to rework the curriculum of required training for modern Secretaries/Office Managers.

Nwosu (2015) highlighted Technological innovations, Globalization, vast changes in Business and Office Environment, vast changes in classroom environment as major reasons for continuous change in the general Curriculum of Secretarial/Office Technology and Management. These led to new dimensions in Curriculum, Nomenclature, Work procedure and techniques, Electronic learning, Electronic meetings and transactions, Physical work environment, Office automation and Office product.

Office Technology and Management is a nomenclature that has taken the place of secretarial studies programmes in Polytechnics, Colleges of Education and Universities in Nigeria. The change was approved by the National Council for Colleges of Education (NCCE) in 2008, National Board of Technical Education (NBTE) in 2004 and National Universities Commission (NUC) in 2004. These are the supervising bodies for Colleges of Education, Polytechnics and Universities respectfully. Adelakun (2009) opined that the OTM programme was designed for two major reasons. First, it is as a response to the yearnings of the Secretarial Studies students and practitioners on the need to change the name of the programme as they are only relevant at the traditional office environment. Secondly, and most importantly, as a result of the change in curriculum with more emphasis on Information and Communication Technology (ICT) and Management so as to enrich the knowledge of the students and to equip them with necessary skills needed in today's office environment.

Secretarial functions everywhere in the world have undergone a lot of technical changes. As a result, modern office equipment which give the Secretary/Office Manager the opportunity to increase her efficiency abounds. The diversities of modern Office Technology require the Secretary or Office Manager to possess new skills and sub-skills to enable him or her to be relevant in the modern office.

Azuka (2000) stated that no one will deny the fact that the hardware of new technology is changing the way Secretaries or Office Managers do their job. The rapid introduction of scientific inventors and innovations sink into obsolescence and has forced the Educational Institutions to introduce as well as apply new skills and competencies in the teaching and learning of Office Technology and Management.

In a traditional teacher-centred classroom, the students are listeners and followers. Changes in content based on work expectations and more importantly changes in how the content is taught require the deployment of relevant pedagogical capabilities. Reynoldson and Vibert (2005) defined pedagogical capability as the capacity to assist in teaching in the broadest sense of the word and include visualization and simulation using visually rich means of instructions such as rich pictures, concept maps, embedded with hyperlinks and electronic learning assistants and games that replicate real world activities such as E-communication. It also includes teaching activities involving direct links between the world of work and the classroom.

Office Technology and Management Education has always been dedicated to preparing its graduates for the world of work. Akinyele (2015) opined that students learn job specifics and employability skills and are given opportunities to use these skills through work experience programmes that connect them with the work environment. She further asserted that to be effective in preparing students for a changing workplace and society, Office Technology and Management (OTM) must extend beyond the delivery of theory but also correct required skills and work experience. A common way to promote "deep learning" is to have participants engaged in self-directed inquiring and personal reflection to develop content strategies (Hmelor, 2007).

Literature Review
A lot has happened in office management in decades. The first typewriter was introduced in 1870, while Alexander Graham invented the telephone in 1880. Electric Typewriters were

introduced in 1920 and Duplicators, Dictaphone and Intercom were developed in 1930. Some other office machines like Calculators, Computers, Franking Machine, Addressograph and Accounting Machines were introduced in 1950. The year 1961 recorded the launching of Memory Electronic Typewriter while Word Processing Equipment and Cash Registers were launched in 1964. Nothing much happened between this date and 1970 when there was the introduction of Digital Network and LAN which also gave way to the introduction of computerized telephone networks and picture phones in 1980. Personal computers, micro processing equipment, electronic mail, fax machines, modems, cellular phones and internet system came into limelight in 1990s and these were improved upon with the outcome of Tablets surface and several other devices with improved version of existing electronics used in the office. Smart boards and improved versions of software had been an ongoing projects being updated almost daily.

In modern office, the Secretary or an Office Manager needs to have competencies in the following areas: Word processing (proper and efficient use of personal computers in composing, revising and preparing all types of documents); Data processing (collecting, organizing, analyzing and summarizing of data in numeric form); Information management and transmission (organizing, maintaining and accessing of records and the communications of information within and outside the organisation); Human and Public Relations (cooperate and handling of situations satisfactorily); General Management (principles of management and getting work   done cooperatively and productively (Nwosu, 2015).

Based on the above emergence, higher institutions of learning in Nigeria came up with the following additional courses: Information and Communication Technology, Modern Office Technology, Desktop Publishing, Web Page Design, ICT Office Application, Office Administration and Management, Computer Appreciation and Computer Application.

Riorden (1993) pointed out that the dominance affordances of teaching in higher education continued to be restricted to:
(i)   lecturing and delivering or presenting information
(ii)   teaching taking place predominantly within the classroom.

According to Fowler and Mayes (2000), this representational view of learning with its concomitant acquisition of knowledge metaphor determines the design of many learning environments. This acquisition of knowledge metaphor is also dominant in learners' conceptions of learning as illustrated in memorization or rote learning which occurs out of context. Over the decades, the advent of the internet has presented challenges to these practices of learning and teaching.

Modern Methods of Teaching and Learning

Bolarinwa (2015) found out that, the use of palmtops, tablets, projectors, audio recorder, transcribing machines and dictating machines with voice recognition software fall short of requirements for effective implementation of Office Technology and Management Curriculum.

The acquisition metaphor of learning, with its connotations of passive learning is now being substituted by a 'participation' metaphor which emphasizes the active involvement of

students in the learning process. Current designs of learning incorporates ICTs include student cohorts and teachers who bring in different tact assumptions about the nature of teaching and learning. Ramsden (2003) placed emphasis on active participation and social aspects of learning yet guided by the discipline they teach in serving as the framework for the design of learning experiences which will ensure that students develop the understanding and abilities they need in order to respond to and shape the world in which they live. Realizing the above led to introduce the different modern methods of teaching such as:

1. Instructional Scaffolding

Scaffolding instruction provides for a supportive learning environment whereby students are free to ask questions, provide feedback and support their peers in learning new material (Nwosu, 2015). A teacher becomes a mentor and a facilitator of knowledge rather than the dominant content expert. Larking (2002) provided the following simple structure of scaffold instruction: Instructor does it, Class does it, Group does it and Individual does it. Scaffolding promotes learning through dialogue, feedback and shared responsibility (Ahbali, 2006).

2. Reciprocal Peer Tutoring (RPT)

This is a term that has been used to describe a wide array of problems, but most of the research on its success refers to students working in peers to help one another learn material or practice an academic task (Ahbali 2006). It works best when students of different ability levels work together. Akinyele (2015) submitted that Reciprocal Peer Tutoring is effective in teaching and learning Entrepreneurship Education as it takes care of students at all levels of understanding. Reciprocal Teaching is a cooperative learning instructional method in which natural dialogue models and discussion reveals learners' thinking process about a shared learning experience (Foster & Rotoloni 2005). In this method of teaching, text must be at a level that can be effectively shared, not too easy and not too difficult. Appropriate support and feedback must be given to facilitate during Reciprocal Teaching Activities (Oczkus 2003).

3. Mobile Learning (M-Learning)

This method of teaching and learning is carried out with the use of mobile devices (smart phones, tablets and handheld computers) in accessing and using course content (Nwosu 2015). It is an aspect of E-learning that uses small screen with subscription to internet services.

4. Quest Based Learning (QBL)

This is an instructional design that leverages elements of game design to support students. It can take the form of multiple, individualized and flexible pathways to learning. Students select activities called quests, earn points and badges as motivation and allow feedback. It is similar to gamification but time and monitoring by teacher may pose a problem. Darling Hammond (2008) reported that most of today's jobs require specialized knowledge skills, including the capacity to design and manage one's own work, communicate effectively and collaborate with others. Research ideas are collected, synthesized and analyzed to develop new products and apply many bodies of knowledge to novel problem that arise. This view of knowledge suggests that students learn best when the subjects are meaningful to them. Students' task must have an authenticity and a sense that the work being done in the

classroom is "real work" that reflects the living realities to the discipline being taught (Western and Northern Canada Protocol [WNCP], 2011)

5. Interactive Teaching Method Using Smart Board/Whiteboard

Interactive Smart Board uses touch detector for user input as normal input into personal computers (Nwosu, 2015). It has flick and scroll features with four pens (black, red, green and blue) with one eraser. Jukes (2008) opined that today's children require more instantaneous feedback and gratification from in order to maintain engagement in learning activities. According to Stokes-Jones (2010) stated that Smart Board allows teachers and students to interact in novel ways that increases student participation in the classroom.

6. Integrated Instructional Model

Out of numerous instructional strategies or models, multiple i.e. more than two or three instructional strategies are selected, integrated and used for teaching a group of students.

7. Flipped Classroom

When using this method of teaching and learning, teacher provides module to the students before the actual teaching. Students then use webinars, podcasts, blogs, videos and online lectures in CD-ROMs to learn about the subject matter. Class time is used for clarifications, reflections, applications and evaluation. Case study, project-based learning etc. are used to deepen learning. It is student-centered and technology-driven (Nwosu, 2015).

Statement of the Problem

The researchers observed that new Office Technology and Management Curriculum cannot be taught and learnt using old method or conventional teaching method (lecturing). Students produced using traditional method of either go out for further training after graduation or fail in the world of work. There is need for lecturers who are to teach emerging technologies and modern office expectations to be up-to-date using modern methods of teaching.

Design of the Study

Survey research method was used for the study. It is appropriate because it was used to deduce the capability, exposure, opinion and beliefs of respondents.

Purpose of the Study

The main purpose of the study is to find out the depth of modern methods of teaching known to lecturers teaching Office Technology and Management in higher institutions of learning. How much of these methods are being used and effectiveness are the modern teaching methods?

Research Questions

The following research questions were used as guide for the research works:
1. How much of modern methods of teaching are known by Lecturers teaching Office Technology and Management in higher institutions?
2. How many of these teaching methods are used by the lecturers?
3. How effective are these new methods of teaching?
4. What are the challenges faced by lecturers in the use of emerging methods to teach Office Technology and Management (OTM) courses?

Population

The population of the study comprises all OTM lecturers in Ogun State:

- Olabisi Onabanjo University, Ago-Iwoye - 3
- Tai Solarin University of Education, Ijagun, Ijebu-Ode - 2
- Federal Polytechnic, Ilaro - 11
- Moshood Abiola Polytechnic, Abeokuta - 14
- Federal College of Education, Abeokuta - 8
- Tai Solarin College of Educa   tion, Omu, Ijebu-Ode - 6
- Yewa College of Education, Ayetoro Road, Abeokuta - 1
- Total number of population/respondents = 45

Because the population is not much, all OTM lecturers totaling 45 were used for the research work. All the lecturers formed the population as samples will be too few

Instrument

20 item questionnaire based on four (4) research questions above were used to elicit responses from respondents. The responses are to find out awareness, knowledge and use of emerging modern methods of teaching.

Data Collection Methods

A questionnaire was designed to gather data from lecturers teaching OTM courses in higher institutions of learning in Ogun State, Nigeria. The researchers were   able to retrieve 42 of the 45 copies distributed. Data collected on the research work titled "Adequate Use of Emerging Modern Methods of Teaching Office Technology and Management in Nigeria" were analyzed using Cronbach Alpha Coefficient formula, the alpha analysis yielded a reliability coefficient of .90.

Validity and Reliability of the Instrument

The questionnaires were pilot tested in Federal College of Education (Technical) Akoka, Lagos to ensure the reliability of the instrument. The College has similar characteristics with the area of study.

Data Analysis

Data collected from the respondents (lecturers of OTM in Ogun State) were analyzed using Descriptive Statistics. The researchers used Descriptive Statistic technique such as percentage to calculate the frequencies of the data gathered. Any item with a percentage response of 50% and above was accepted and below 50% rejected.

Results

Research Question 1: How much of modern method of teaching are known by lecturers of OTM in Ogun State?

Table 1: *Level of awareness and use of modern methods of teaching*

S/N	METHOD OF TEACHING	AWARENESS		ADEQUATE USE		REMARKS
		Yes %	No %	Yes %	No %	
1.	Scaffolding Instruction	20	80	20	80	NA & NA
2.	Reciprocal Peer Tutoring (RPT)	65	35	05	95	A & NA
3.	Mobile Learning (M-Learning)	85	15	20	80	A & NA
4.	Quest Based Learning (QBL)	89	11	80	20	A & A
5.	Interactive Method of teaching using Smart Board	07	93	05	95	NA & NA
6.	Integrated Instructional Model	05	95	02	98	NA & NA
7.	Flipped Classroom	03	97	01	99	NA & NA

Keys: A & A   -   Aware and adequately used
       A & NA   -   Aware and not adequately used
       NA & NA   -   Not aware and not adequately used

Research Question 2: How many of these teaching methods under study are used by OTM lecturers?

Table 2: Use of emerging methods of teaching under study

S/N	METHOD OF TEACHING	1	2	3	4	REMARK
1.	Scaffolding Instruction	98	1	1	-	TR
2.	Reciprocal Peer Tutoring (RPT)	-	08	02	90	TR
3.	Mobile Learning (M-Learning)	05	05	10	80	TR
4.	Quest Based Learning (QBL)	-	-	20	80	TR
5.	Interactive Method of teaching using Smart Board	98	1	1	-	TR
6.	Integrated Instructional Model	80	5	5	10	TR
7.	Flipped Classroom	100	-	-	-	TR

Keys:
1   -   Never used
2   -   Tried before
3   -   Used somehow
4   -   Never used
TR   -   Training Required

Research Question 3: How effective are these methods of teaching?

Table 3: Effectiveness of emerging methods of teaching

S/N	METHOD OF TEACHING	1	2	3	4	REMARK
1.	Scaffolding Instruction	98	-	2	-	TR
2.	Reciprocal Peer Tutoring (RPT)	-	-	20	80	TR
3.	Mobile Learning (M-Learning)	02	15	13	70	TR
4.	Quest Based Learning (QBL)	-	-	20	80	TR
5.	Interactive Method of teaching using Smart Board	70	10	10	10	TR
6.	Integrated Instructional Model	10	40	10	40	TR
7.	Flipped Classroom	60	30	10	-	TR

Keys:

1 - Not known
2 - Think it must be effective
3 - I know it is effective
4 - I am certain it is effective
TR - Training needed

Research Question 4: What are the challenges faces by lecturers in the use of emerging methods of teaching to teach OTM courses?

Table 4: Challenges faced by lecturers in the use of emerging methods of teaching

S/N	CHALLENGES	YES	NO	REMARK
1.	Inadequate awareness	80	20	
2.	Inadequate theoretical understanding	90	10	
3.	Inadequate ICT Equipment/Resources	98	02	
4.	Lack of Technical/ Technological support	99	01	
5.	Poor power supply	60	40	
6.	Insufficient e-learning literacy	50	50	
7.	I just can't learn new methods	80	20	
8.	Limited time allocation to courses	90	10	

Findings deduced from the data analyzed show that majority of the respondents believe that these emerging methods of teaching will make teaching of OTM courses more effective but they are not well grounded in the theoretical and practical knowledge of the methods. Majority of the respondents have never tried the use of these emerging teaching methods, majority of the respondents are of the opinion that the emerging method of teaching will be effective in teaching OTM courses, OTM lecturers are facing challenges of inadequate awareness about the emerging methods of teaching, inadequate theoretical understanding, inadequate ICT equipment resources, lack of technical/technological support, poor power supply and insufficient E-learning literacy.

Conclusion
Based on findings of this study, modern methods of teaching which includes Scaffolding, Reciprocal Peer Tutoring, Mobile Learning, Quest Based Learning and others are good methods of teaching modern OTM courses for excellent performance in modern offices. This

is to enhance skills and knowledge on cooperative and productive using modern equipment. They are common and good ways to promote 'deep learning'. Lecturers of OTM need to be exposed to theoretical use of these modern methods need to be encouraged with conducive environment and need to upgrade their skills as new methods emerge.

Recommendations
Based on the conclusion, the following recommendations are proffered that lecturers should be trained on the use of these emerging teaching methods. This should be included in the training of OTM Teacher Education. Lecturers need to go for In-house trainings, Workshops, Seminars etc. where they will be exposed to these methods of teaching. Conducive teaching environment, ICT Resources, regular power supply, sufficient allocation of time for OTM courses etc. should be enhanced in higher institutions of learning. Lecturers should always be open to new things as they teach OTM courses.

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TRANSFER OF HANDS-ON-SKILLS IN TEACHING AND LEARNING CIVIL TECHNOLOGY IN TECHNICAL SCHOOLS

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Abstract

The integration of the theory and practical components in the teaching and learning of the Civil Technology subject is requisite. This is to ensure the transfer of the much needed hands-on skills in a country desperate for technological emancipation. It is regrettable that some South African schools offering the Civil Technology subject have been found wanting in this aspect. This paper therefore investigate the challenges of transferring Civil Technology hands-on skills and how these challenges can be resolved in order to move the subject forward. The study was conducted on 41 Grade 12 learners and 3 teachers from the three senior secondary schools in the Eastern Cape Province. Classroom observations and interviews were conducted with the purpose of ascertaining how hands-on activities were conducted in the workshop. It was established that the teaching of the subject has become too theoretical to the detriment of the psychomotor abilities. Findings revealed that practical activities have been compromised to the detriment of requisite skills acquisition. Findings also proved that safety measures are not adhered to, which is a catastrophic health hazard. It was also found that practical are not included in the time-table in school's weekly activities. The study calls for the Basic Education intervention and thorough proper monitoring to develop the teaching and learning of Civil Technology requisite skills, as this is considered to be one of the panaceas for the country's unemployment burden.

Keywords: Hands-on skills, Civil Technology, practical skills, Eastern Cape, theory and practical

INTRODUCTION AND BACKROUND

The Grade 10-12 Civil Technology curriculum in South African schools' policy prescribes the subject to infuse both the theoretical and practical aspect. The policy document for the subject advocates 4 contact periods a week, with 2 hours for theory and practical respectively (Department of Basic Education, DBE, 2014, p. 15). Therefore, the need to infuse the practical into theory remains key. This is because Technology education curriculum should be designed to train individuals to become craftsmen, technicians and technologist in different occupational areas (Rufai, BinMusta'amal, Kamin & Saud 2013, p. 74). Umar & Ma 'aji (2010, p. 65) contested that this aspect of the curriculum can only be implemented where facilities in the workshop are adequate and relevant. This should be vital to create school graduates who will be able to earn an income in a country where unemployment rate is sitting at 24, 10% (Trading Economics, 2014). School workshops offer opportunities for practical training of learners in the acquisition of skills in different trade areas (Rufai, BinMusta'amal, Kamin and Saud, 2013, p. 75). Furthermore, Kennedy (2011, p. 53) maintains that the training received by learners in technology education these days is too theoretical to the detriment of the practical aspects of the lessons. Sadly, Chinyere (2010, p. 82) discovered that what is available in schools for technology skills training is a situation of inadequate training facilities in the form of materials, tools, equipment, workshops and inappropriate delivery

method. The teaching and learning of Civil Technology in some South African schools currently is of a serious concern as learners graduate Grade 12 without requisite basic hands-on skills.

Hands- on skills are found in many subject areas of technology education such as Electrical Technology, Mechanical Technology and Civil Technology (Kennedy, 2011, p. 54). In Civil Technology, through the integrated completion of theoretical work and the practical assessment tasks (PAT) hands-on skills in respect of safe working practices; good housekeeping; first aid practices; erection of structures; working with accurate measurements; and workshop practice will be developed (Department of Basic Education, DBE, 2011, p. 9).The training in this regard can only be practically conceivable if there are materials and equipment for leaners to manipulate.

THE SIGNIFICANCE OF PRACTICAL LESSONS IN CIVIL TECHNOLOGY

Workshop training offers learners an opportunity to manipulate equipment and to work with other materials. This in turn helps learners to make the connection between real life situations and the classroom instructions. The technological education is considered as a formal type of education for providing suitable skills, practical skills and scientific knowledge to make learners ready to join labour market (Ahmed, 2011, p. 22). Like any science based subject, Civil Technology should integrate both the theoretical and practical component for practical to complement theory. Ideally the workshop in schools should provide equipment and material in order for learners to acquire practical hands-on skills (Umar & Ma 'aji, 2010, p. 65).

Chinyere (2010, p. 84) posits that practical work constitutes an essential component of technology education. The use of practical work is to illustrate theory as contested by Johnstone and Al-Shuaili (2001, p. 42).It should be noted that theoretical understanding is gained relatively slowly through practical work (Reid and Shah, 2007, p. 175).This simply means that learners need practical work to make sense of theory. In Civil Technology, the use of practical work is the key to help learners understand theoretical concepts. This is supported by Mewis's (2011, p. 44) assertion that practical work help to support learning and also illustrate key concepts. In the same vein, Seiter (2009, p. 422) recommended that for learners to develop manual skills and cognitive reasoning in technology education, they must be given access to workshops which will allow all possible methods of working with materials and equipment. The teaching and learning of both theory and practical are key components in the handling of Civil Technology subject and should one of these two key components be removed, the subject's objectives will seriously be handicapped. The consequences of this will be undesirable as learners will graduate high school unprepared in the practical aspect of the subject.

THE CHALLENGES FACING CIVIL TECHNOLOGY TEACHING AND LEARNING IN SCHOOLS

All technology-based subjects require more instruction and practical time than arts and science education (Boateng, 2012, p. 110). Umunadi (2010, p. 5) avers that schools offering technology subjects face inadequate funding and facilities, inadequate and inappropriate

staffing. In the same vein, Kennedy (2010, p. 21) declares that facilities like workshops equipment and materials are grossly inadequate in schools and therefore pose a serious challenge in the teaching and learning of technology subjects like Civil Technology. This does not argue well for the holistic teaching and learning of the subject. In the absence of facilities like workshop and materials, the subject becomes theoretical to the detriment of practical acquisition. It should be noted that the teaching of Civil Technology, just like any practical subject is centered on the practical lessons. However, Moemeke (2010, p. 95) insists that practical work as means of developing skills in creativity and mental skills have been so highly neglected in schools. Like any technology-based subject, the development of both creative and mental skills remains key for the successful teaching and learning of Civil Technology. Without this, the offering of the subject becomes a deception.

PURPOSE OF THE STUDY

Learners in some South African schools graduate Civil Technology Grade 12 class without the basic hand skills required to enter the technical world of work. This unfortunately add numbers to the already high unemployment rate in the country. The purpose of this study was to investigate the teaching and learning of Civil Technology practical in technical schools .The following research questions becomes key in the investigation:
1. How is the Civil Technology practical component handled in selected schools in terms of teaching and learning?
2. What is the significance of the practical aspect of the subject in relation to employment opportunities

METHODS

The study adopted a qualitative research design in carrying out the investigation. Henning, Van Rensburg and Smit (2009, p. 3) describe a qualitative study as a study which aims for depth than quantity of understanding. Therefore the study made use of structured interviews as well as classroom observation. The interviews were commonly structured and standardized for all the sample schools. All the teachers were interviewed in their respective schools. Observations were also carried out as another method to get first-hand information and to adduce more evidence on how Civil Technology practical activities are being conducted. The observation schedule was adapted from Differentiated Classroom Observation Scale Protocol (Grant, Stronge and Popp's, 2008, p. 70).The researcher spent the whole day for 2 weeks in each of the three selected schools observing how the practical component of the subject was being handled whiles activities were underway. The interview data was first analyzed by transcribing. Each transcription was considered with the aim of identifying key issues. Descriptions were then formulated from the key issues identified as relevant to the study and coded. Themes, which are a pattern of answers emerging consistently and more often to highlight a common issue, were created, and then categorized into headings and constructively narrated with the support of verbatim.

Data derived from observation was analyzed descriptively per item that was reflected in the schedule. Each item that the researcher had on the observation schedule was analyzed per school with the purpose of getting a connection of the activities in the Civil Technology workshops in the three schools. The analyses was mainly done by paying attention to all the

items in the observation schedule and themes were developed from the field notes obtained from what the researcher observed from the three selected schools. The results were narrated to give a true reflection of what was observed.

POPULATION AN SAMPLING

A "population" consists of all the subjects you want to study (Yount, 2006, p. 2). The population in this study comprised of three schools offering Civil Technology in the Eastern Cape Province. These schools are situated in three different districts around the Eastern Cape Province. The researcher selected these schools on the basis of their immediate vicinity and accessibility.

Dasmani (2010, p. 62) denotes that the importance of samples lies in the accuracy with which they represent or mirror the target population. This study employed the judgmental /purposive sampling technique. All the Grade 12 learners together with their three educators from the three selected schools, were considered to be relevant to the study by virtue of them being involved in the teaching and learning of Civil Technology. Battaglia (2011, p. 405) describes purposive sampling as a non-probability sampling method aimed at producing a sample that can be considered "representative" of the population. In the three districts, the researcher selected one school in each as his sampling technique totaling three in numbers. The respondents consisted of an easily manageable number of 41 learners in total combined from the three schools, with 25 boys and 16 girls.

RESULTS

INTERVIEWS WITH CIVIL TECHNOLOGY LEARNERS

Theme 1: I KNOW ALL THE TOOLS IN THE PRACTICAL WORKSHOP AND HOW TO USE THEM

Three-quarters of the respondents said they do know most of the tools theoretically, but they have no access to them as they are not there in the workshop. Learner A said "I cannot use most of the tools as some of the tools are not in a good condition". However, learner B said the following "*We have no tools to work with, so I know most of the tools as I see them in the text book*". This is corroborated by Nwakile and Oloruntimehin (2010, p. 12) avowal that the poor funding of educational institutions has made it difficult to provide the needed educational facilities therefore rendering workshops ill equipped.

Notably, the non-usage of tools in workshops is a blow to learners' acquisition of skills as tools are critical in the learners' everyday work in the workshop. This unpleasant response from Grade 12 learners, which is the exit point at schools is outrageous for a subject considered practical.

Theme 2. STATE OF WORKSHOPS IN SCHOOLS

In responding to the aspect above, the following theme was recognized consistently from the learners' responses: *Not in a good condition due to lack of space, equipment and personal protective equipment (PPE's)*. Personal protective equipment (PPE's) can be described as the equipment worn from head to feet, in order to protect workers from injuries and contracting

diseases in the workshop. Learner C said "*practical workshops are normal class size and that they do not have much space to move around*". In addition to that, learner D said "*our workshops are not adequately equipped and lack equipment, material and PPE's*". According to the National Unions of Teachers (NUT) Health and Safety Briefing report (NUT, 2011,p. 11) , all practical activities can become hazardous in some circumstances due to factors such as ,the suitability of the teaching area and non- usage of personal protective equipment.

Theme 3: LEARNERS' PREPARATION OF PROJECTS

The researcher wanted to establish how learners prepare their material whenever they get a chance to work in the workshop. Teacher B from School B in answering the question on how learners do their projects said: "*As the material arrive late, for us to complete the project and meet the deadline for PAT moderation I have to step in and help cut the material for the learners. Ideally learners were supposed to start with the project from working out a cutting list for all the material required for the project, then plane and cut wood to the required sizes and assemble the parts under my supervision and guidance.* Teacher C from School C responded by saying: "*In the case of wood work project learners have to work individually to get their 25% of the practical mark. I buy readily made material for the learners to assemble. This is due to the fact that the workshop does not have most machinery to prepare the material for the project. Time constrains is another factor as the school always buy us the material in the fourth quarter*". The responses from the teachers above are a clear indication that the focus in the workshop is to ensure that learners get marks for the practical. With limited time, lack of tools and equipment to prepare material for the projects in the workshop, teachers are left with no choice but to tap in or even buy readily made material in order to help learners get good practical mark. This is anchored by Maeko and Makgato (2014, p. 332)'s assertion that time constrains , lack of material and equipment makes skills acquisition impossible as the time Civil Technology learners spend in the workshop is too short to enable them to acquire the required skills . The authors also established that teachers are left with no choice but to buy readily made material and to help learners with the project in return of good marks.

Theme 4: TIME FOR STARTING WITH THE PRACTICAL PROJECT FOR GRADE 12 CLASS

The respondents asserted in no uncertain terms that the learners only start with the practical lessons in the 4th quarter, which is around September. The teacher from School A stated that the practical were supposed to start earlier at the beginning of the year to give learners more time to practice skill. He had the following to say: "*We were supposed to start at the beginning of the year to equip learners with practical skills, but because of the lack of material we do projects in the fourth quarter when moderation is about to take place just to meet the Civil Technology curriculum requirements as opposed to skill acquisition . We are sent from pillar to post when we knock on provincial government doors asking about material and equipment for learners*".

INTERVIEWS SUMMARY

The respondents unanimously indicated that the practical component of the subject help learners understand the theory part of the subject. The respondents are of the view that for learners to become self-employed and create jobs upon completion of their Grade 12 without

any further training, they should regularly engage with materials and equipment. However, teachers felt that the current training learners are exposed to do not offer them such opportunities. These teachers felt that the acquisition of skills without properly equipped workshops is impossible. Furthermore the interviewees stated that they are forced to spend most of the time teaching theory which does not augur well for a practical subject like Civil Technology.

RESULTS FROM OBSERVATIONS

Classroom observation revealed the following:

<u>Theme 1</u>: AVAILABILITY OF EQUIPMENT, MATERIAL AND SAFETY ISSUES

Notably, in all the workshops in school A, B and C respectively, the availability of equipment and material is a problem. The finding from the researcher's observation is that in all the three selected schools materials like timber and safety gear is a big challenge. Though 1 school have few working machinery and few tools, material is in short supply. This exposes both teachers and learners to serious health hazards.

The workshop can be a dangerous place to work in as it contains sharp objects and dangerous machinery. With regard to this variable, the researcher observed that in all the sample schools, safety is only considered when operating the available machinery together with the handling of tools by taking safety positions when working. This then leaves both teachers and learners exposed to health hazards emanating from saw dust and injuries from flying wooden chips. All the learners together with their teachers were seen to be working without Personal Protective Equipment like safety goggles to protect the participants' eyes from flying wood chips, dust masks to prevent inhaling of dust which might cause lung diseases. Leaners together with teachers were observed to be working in dust and noisy environment caused by machinery without PPE's. Notably, woodworking exposes workers to a variety of hazards, including kickbacks, flying wood chips, noise, wood dust and chemical hazards. Personal Protective Equipment can help protect against these hazards (NUT, 2011, p. 17).

CONCLUSION

The responses indicate that learners are not exposed to the practical activities as they should. The lack of material and equipment is central to this challenge. As indicated by both the learners and their teachers, the shortage of these basic requirements in the practical workshop impact negatively on the learners' acquisition of practical skills. This is attested by Gwembire and Katsaruware (2013, p. 02)'s findings that all Technology Education subjects require specialized workshops equipment and material in promoting effective transfer of practical skills . The insufficient time spend in the practical workshop is a clear indication of how schools view the integration of practical lessons in the Civil Technology syllabus. The serious shortage of basics like PPE's is a serious indictment defeating the goals for effective teaching and learning of any practical based subject.
From the investigations, the study can construe the frustration from the responses of both the learners and teachers. For a country that is advocating the economic growth, this is a serious setback with reference to the learners coming from such schools in the sample study. It is therefore recommended that the National Department of Basic Education intervene to restore the dignity of the subject. This can be done by dispatching a group of experts to do needs

analysis in the sampled schools and provide assistance. That should be followed by proper monitoring to ensure that the intervention is sustainable in such a way that practical are not only integrated in the time-table, but taught.

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CREATING ACCENTED TEXT-TO-SPEECH ENGLISH VOICES TO FACILITATE SECOND LANGUAGE LEARNING

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Abstract

Speech synthesis systems can be used for language learning by additional language speakers. In this paper, we present an approach of creating English voices as spoken by additional language speakers that can be used to facilitate such learning. The quality of voices created will be measured in terms of their intelligibility, similarity and naturalness. The text-to-speech (TTS) synthesis system to be developed will be focusing on English as spoken by South Africans who are additional language speakers of English. We are going to adopt an existing speech synthesis toolkit, The Hidden Markov Model (HMM)-based speech synthesis system (HTS) engine in creating our voices. We will use existing sentences for recording the speech training data. The speech data will be recorded from male and female South Africans who speak English as their additional language. The created voices will be very useful for incorporation into voice enabled software applications that are targeted at additional English speakers.

Introduction

English is one of the official languages of South Africa pre-1994 and post-1994. However, it is not a first language to the majority of South Africans. As such, English is learned as an additional language in schools by the majority of South Africans. Text-to-speech (TTS) synthesis systems can be used for language learning by additional language speakers of the target language. TTS synthesis systems convert any given text in a particular language to its equivalent speech sound. The importance of second language learning has become a national issue in improving the standard and quality of our education in the country. From the latest Annual National Assessment (ANA) report released December 2014, one can conclude that urgent interventions are needed to improve the learners' overall academic performance, (Department of Basic Education (DoBE), 2014). Since majority of learners in South Africa are blacks, this means additional speakers of English performed badly in Mathematics, Science and English.

For quality synthetic voices and speech synthesis systems, first language speakers of English are used in the development of most TTS synthesis systems. With the different types of spoken English languages in our country – by first language speakers, Afrikaners, Coloured, Indian and South African indigenous languages speakers, using only the first language speakers for the creation of synthetic voices in TTS synthesis systems only benefits the minority group of speakers, not the majority of additional speakers of English. The South African indigenous languages speakers is a heterogeneous group on its own because it comprises of different cultural groups and geographical locations which influence to the type of English spoken. Each cultural group carries its accent when they communicate in a second language and this form a dialect to the second language and that may hinder the

communication with a native speaker of that language. With the widely available technology, most non-native learners still view the classroom as the only environment to learn English. If learners from rural communities and townships can be introduced to the mobile technology software applications that can assist them in language learning (such as TTS synthesis system) that may change their perspective of viewing English as the subject they need to pass to progress to the next grade but as a language they need to know to communicate with the world.

Information Communication Technology (ICT) has a very significant role in our everyday lives. "Information and communication technologies (ICT) have become commonplace entities in all aspects of life. Education is a very socially oriented activity and quality education has traditionally been associated with teachers having high degrees of personal contact with learners. The use of ICT in education lends itself to more student-centred learning settings. But with the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century" (Noor-Ul-Amin, *unknown*).

Objective

- In this study, we propose to develop English spoken in one variety of South African accents (not first language speakers' accent) text-to-speech synthesis system for online mobile language learning facilitation that is targeted to assist South African indigenous languages speakers.
- The accented text-to-speech English voices will benefit visually and physically impaired learners by reading out the text for them.
- With technology advancing daily and the technology-advanced generation, it will be easy for them to know, understand and use the TTS synthesis system.
- Understanding the importance of second language in our education system, our main objective is to provide a technological resource that learners will use and enjoy while they learn and also make second language learning not be restricted to the classroom only.

Related work/literature review

In the study conducted by InfoDev PriceWaterhouse Coopers (2010) Information Communication Technology (ICT) has the ability to improve the education experience for learners who:

- Live in rural and remote rural locations.
- Have special learning needs, like those in special schools.
- Have physical disabilities constraining their access to schools.
- Have dropped out and/or have kept themselves out of school for various reasons.
- Aim for excellence and fail to get satisfied in the current system.

The usage of ICT in both primary and secondary schools is very important as it elevates the pass rate and also assists in producing quality in the education system. India has employed various ICTs over the years to promote primary and secondary education. Even the

governments in every country in the South Asian region are keen in rolling out the use of ICTs for school education because of the realization of the promotion of quality education being enabled through ICTs.

Owen-Smith (2010) says, additional language needs six to eight years of well-resourced teaching before it can be successfully used as a medium of teaching and learning. Whereas most rural schools are not well resourced, so this will mean more time is needed to teach a second language before it can be adopted as a medium of instruction. As a result of the transition in the language used as a medium of instruction in grade 4, the non-native English learners have to learn the new medium of instruction while the native English learners use the same medium of instruction from grade 1 to grade 12. While non-native learners are still battling with the basic of the second language, they have to apply it in learning other subjects' matters. This will result in poor performance in both the Annual National Assessment and the end of year progress.

According to Somers (2005), TTS systems are available for a number of the world's major languages, but for thousands of the world's 'minor' languages no such technology is available. Despite the impressive list of languages provided by Scansoft's *RealSpeak,* American and British English, Dutch, French, German, Italian. Japanese, Korean, Portuguese, Russian, Spanish, Basque, Cantonese, Mandarin, Danish, two varieties of Dutch, Australian and Indian English, Canadian French, Norwegian, Polish and two varieties of Portuguese, there are still thousands of languages not covered. TTS synthesis system is viewed as an important technology for people with limited or no English at all, poor reading ability in their own language due to different reasons – low literacy, visual impairment or dyslexia. In South Africa with the variety of English dialects based on geographical locations and cultural groups and with the little online TTS synthesis system technology even for the native speakers of English, systems that cater for English dialects may play significant role in availing non-native accent English voice.

In the study conducted by Meihami (2013), it was found that the use of TTS systems in the classroom has a significant impact in improving language learning and usage for native speakers of the respective language. Although native speakers are said to produce best TTS systems, however, due to their speech rate and accent, non-native learners hardly understand their speech. As a result, this defeats the purpose of the system in a predominantly non-native speaker of English community. Though we have TTS synthesis systems online, but in most cases native language speakers are used in developing most globally available English TTS (Episcopo, 2009). All the six voices available on the Festival TTS online demonstration one realises that not even a single African voice of a native speaker of English is present. Another similar speech synthesizer without an African voice is the Code Welt (CW) Speak Online TTS Synthesizer, it has different voices for different languages but there is no single voice of a native African

Oshima, Takamichi, Toda, Neubig, Sakti, and Nakamura (2015) conducted a similar study as a result of the large disconnect between these two languages, it was noted that English speech read by a native Japanese speaker (English-Read-by-Japanese; ERJ) is highly different from its native English counterpart due to Japanese-accented prosody or pronunciation. From this study one learns the importance of developing TTS synthesis system that synthesizes foreign language speech with a non-native speaker's own voice characteristics because it promise to improve a wide variety of applications like allowing Computer-Assisted Language Learning

(CALL) applications to let learners listen to speech with their own voices. And once learners start to develop interests in such learning facilities, this will automatically improve their second language, subsequently improve their academic performance. Even though the use of non-native speakers in TTS synthesis system development has greater advantages, its drawback is that it deteriorates the naturalness of the synthetic speech.

Motivation

Watson, Liu, and MacDonald (2013) discovered that people from New Zealand actually thought that a robot performed better because it had their voice even though the task and dialogue that the robot performed was exactly the same, but only the voices differed. It was also found that it is the native speaker status of the listener that has the greatest influence on the speech intelligibility. One can conclude from the study that indeed an accent has an impact on how listeners perceive speech and the importance of accent in second language conversations. People react and relate very positively to speech spoken by anyone they share a native language with.

TTS synthesis system has a very important role in improving teaching and learning of new languages, as a result more systems have to be developed for more languages (Somers, 2005). To emphasis the effect of pronunciation, in the preliminary experiment conducted by Kamper (2012) it was found that an automatic speech recognition (ASR) system trained on White South African English data achieved a word recognition accuracy of 50.42% when presented with a Black South African English test set while a similar system trained on Black South African English achieved a word accuracy of 72.84% on the same test set (Black South African English test set) and this is 22.42% word recognition accuracy more than the White South African English trained ASR. The results obtained emphasize the need for the creation of TTS system with different accents because accents contribute significantly in speech recognition from one listener to another.

Methodology

  TTS synthesis system can be achieved in many ways, concatenative, formant and articulatory synthesis. In this study we are going to adopt the concatenative synthesis, which concatenates pre-recorded speech units to produce the speech output. Figure 1 indicates the basic concatenative synthesis.
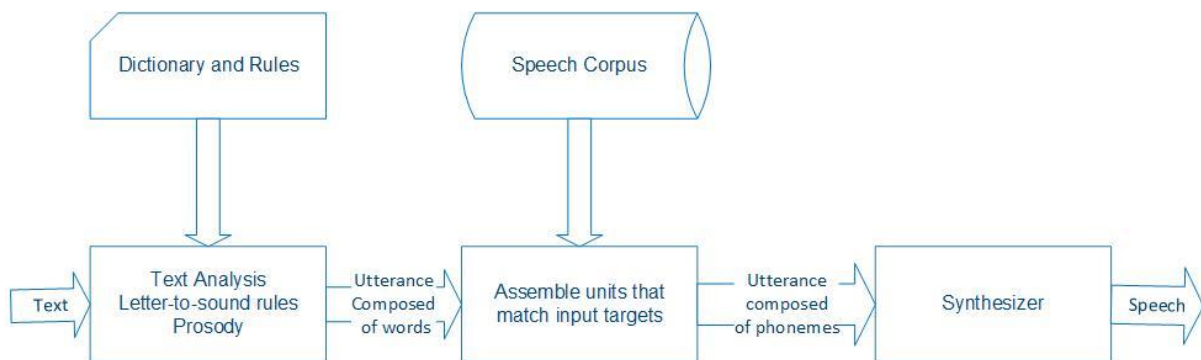
Figure 3: The basic concatenative TTS synthesis.

The HTS is the modern engine that provides more quality, though its drawback is the high volume of training data required. HTS-2007 performs well on both clean and noisy data. We will use existing sentences for recording the speech training data using male and female non-native English speakers. The training text corpus to be utilized will be obtained from the Lwazi project, in the language resource management agency (RMA) catalogue. The recording will be done at night, in a quiet office using a laptop operating on a battery to achieve maximum silence. We are going to develop English voices for second language English speakers. Male and female voices will be developed through recording them reading out the text corpus. The targeted speakers of the TTS system are University of Limpopo students between the ages of 18 and 23. And all the speakers should be from communities dominated by their respective home languages, with a strong Limpopo English accent from their respective environments. The Lwazi prompt text data is already split into sentences. A text processor will be used to generate HTS labels using the recorded sentences and scripts. The system will then be trained based on the recorded sentences used in different combinational sets.

Below we indicate the two stages of HMM-based speech synthesis adopted from Zen, Nose, Yamagishi, Sako, Masuko, Black, and Tokuda (2007). In the training stage, using the speech data from the recordings as our speech database we are going to perform speech analysis. The Mel-Cepstrum and fundamental frequency (F0) will be extracted at each analysis frame using a continuous and multi-space probability distribution, respectively. Then the phoneme HMMs from the speech data will be modelled, and using the Baum-Welch algorithm re-estimation of the context-dependant phoneme HMMs is performed. In the synthesis stage, when text is entered, it will be transferred to context-dependent phoneme labels. Using those label sequence we then create the sentence HMM through concatenating the context-dependent phoneme HMMs. For the speech to be synthesized from the generated mel-cepstral and F0 parameter sequence, we use MLSA (Mel Log Spectral Approximation) filter.
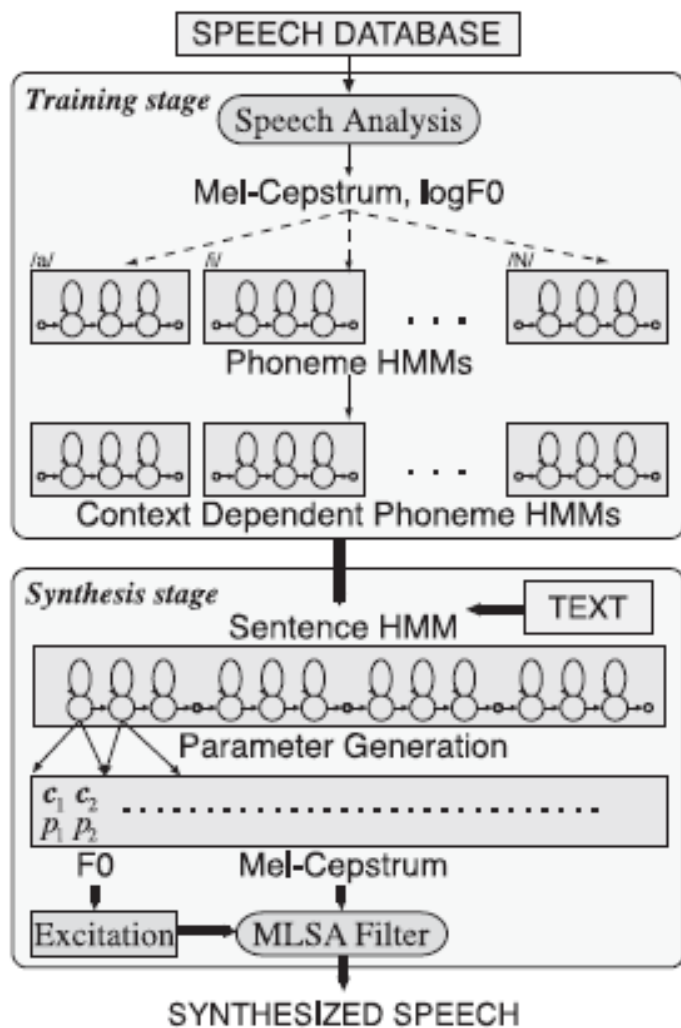
Figure 4: The two stages of HMM-based Speech Synthesis

Lastly, for the listening test we will evaluate our system using the framework from the Blizzard Challenge (Stan, Yamagishi, King, and Aylett 2011). We will recruit non-native speakers of English to evaluate the system for speaker similarity, naturalness and intelligibility. In speaker similarity, we testing if the voices created are similar to the original speakers or not. Listeners will be given no more 3 original recordings and their equivalent synthetic speech samples generated to compare. At the end of the listening session they will rate the system on a scale of 5-point (1 − sounds-like-a-total-different-person to 5 − sounds-exactly-like-the-person). In naturalness, we test how natural do the synthetic voices sound. Listeners will test the system with not more than 3 sentences provided and thereafter rate the system on a scale of 5-point (1 − completely-unnatural to 5 − completely-natural). Listeners will be requested to type or write what they heard to test the intelligibility of the system. Again, after they wrote what they heard, they will be provided with the correct text of the synthetic speech they listened to and be required to rate the system on a scale of 5-point (1 − completely-unintelligible to 5 − completely-intelligible). More focus will be on the results of the latter test between the English native speakers and the Tshivenda native speakers, listening to the same set of recordings. When the text-to-speech synthesis system has passed the entire testing phase, it will then be deployed in one primary, with three learners of different levels of reading capabilities: a confident, a contextual and a struggling reader.

Results/findings

Since the system is still under construction, results from similar research done by Parr (2011) to determine a possible solution for struggling readers, three learners of different reading capabilities are used:

- Mackenzie – a fluent confident reader, who does not require any assistance.
- James – a contextual reader, who needs to be pushed to read,
- Jacqueline – once a struggling reader, but after using the TTS synthesis system is no longer struggling, in fact, reading became interesting.

It was found that Mackenzie comes to school each day with a book on his hands and a smile on his face. TTS synthesis systems are not effective or are disrupting confident readers as Mackenzie reported that it interferes with the "voice in his head". To fluent and accurate readers, a TTS synthesis system requires more than just conventional reading. So since TTS synthesis systems are not that effective to learners who are fluent and confident like Mackenzie, we can

On the other hand, James is rarely seen with a book on his hand, unless it is an information book used for a particular project. For readers like James, TTS synthesis system is not required to support accuracy and fluency but it enhances concentration. Such readers are entitled to choose if they use the system or not. They can still do well in the absence of a TTS synthesis system.

Jacqueline was a once struggling learner but now she comes to school looking forward to reading because the TTS synthesis system is what she always needed to succeed. Learners like Jacqueline need the TTS synthesis system to learn at the same rate as their peers, hence to them it is not just a reading tool. So a TTS synthesis system plays a significant role to learners such as Jacqueline because without it they will not succeed. Hence the importance of such systems is mostly noted in learners like Jacqueline.

From the results, we can note that even though learners like Mackenzie do not find TTS synthesis system very helpful but to learners who struggle to read it is a very useful tool. So without such systems many students who have the potential to progress will not progress because of lack of assisting equipment such as the TTS synthesis systems.

Limitations

Since there are no English speech data by non-native speakers of the different South African indigenous languages readily available online, we have to record. With the lack of recording equipment we conducted our recording sessions in the computer laboratory using a desktop computer and headphones with a mounted microphone. And the computer we are using is Intel(R) Core(TM)2 Duo CPU E7500 @ 2.93 GHz processor with 2.00 GB installed memory (RAM) and that is not enough for running HTS engines because it takes hours to execute some scripts before you get your output.

Future work

If the research succeeds, it will encourage many researchers to consider further localization of synthetic voices to other under-resourced languages of South Africa. Since the non-native English speakers in South Africa are a diverse group due to language dialects, non-native accented English synthetic voices can further be created for each cultural group at any geographical location. And this will provide helpful technological resources to the under-resourced language learners and community.

Conclusions

In this paper, we explained the importance of language learning for non-native speakers. How different people differently comprehend the same speech. We also looked at the importance of accent in speech, the significant role it plays when people communicate. More insight was given on the related work done by other researchers in the field. The method to be used in developing our TTS synthesis system is given in details and the TTS synthesis system tools to be used. We also looked at the characteristics of the speakers and listeners to be used in developing and testing the system. Finally we looked at the results obtained on using a TTS synthesis system on improving the reading and comprehension skills of three different learners with different reading skills. TTS synthesis systems have a great positive impact on learners with reading problems; it ultimately improves and restores their confidence.

Acknowledgements

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SPEECH SYNTHESIS APPLIED TO BASIC MATHEMATICS AS A LANGUAGE

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Abstract

In this world of digital age, computational systems can use human language technologies (HLTs) to facilitate interaction with humans. HLTs make it simple for humans to communicate with machines and this can assist industries and government to make services and information accessible in any language. HLT has an important task to participate in adjusting the historical discrimination opposed to under-resourced indigenous African languages. Upon establishment of text-to-speech (TTS) synthesis systems, human computer interaction (HCI) has grown rapidly. TTS synthesis is the process of converting any text into its equivalent sound. These systems are available for variety of resourced languages such as, English, Spanish, and others. Such systems are not available for under-resourced indigenous African languages. The aim of this paper is to develop a speech synthesis system that reads inputted mathematical equations in Sepedi. The speech synthesis system for Sepedi based on concatenation synthesis discussed in this paper focuses on Sepedi as it is one of the under-resourced indigenous language of South Africa. The speech synthesizer was built for Sepedi in a limited mathematics domain. The synthesizer was able to convert numerical values and some mathematical symbols into Sepedi. The Mean Opinion Score (MOS) results obtained after evaluating the system shows that the system is naturally sounding, pleasant and contains some level of intelligibility.

Key terms: Text-To-Speech synthesis, Human Language Technologies, Human Computer Interaction, Information and Communication Technologies, Indigenous Languages and Language Learning.

Introduction

Speech Technology is all about speech-based interfaces for computer system. It also refers to two basic technologies namely Automatic Speech Recognition (ASR), and Speech Synthesis (Holmes & Holmes, 2001). ASR system is also called speech-to-text system; it converts a spoken utterance into textual form. Whereby speech synthesis system is also called TTS synthesis system as shown in Figure 1; it converts text into speech waveform, and together they form a speech interface. In few decades our community has moved towards the digital age in different aspects. A large quantity of data can be accessible in various computerised form, ranging from multimedia databases (e.g. speech corpus) to full-text databases (e.g. text corpus). The size of digital libraries has grown rapidly; it is predicted that most of scientific information is contained in digital textual form (Nenadić, 2004; Sullivan, 2001).
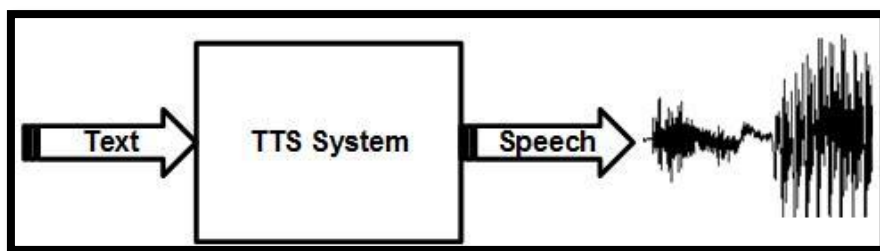
Figure 5: General TTS synthesis system showing text as input and speech as output.

As the digital textual archives increases, it is becoming impossible to locate data without manual assistance. Hence, effective methods are needed to classify, extract and retrieve important information from big textual corpora.

Natural Language Processing (NLP) is a research field aimed to exploit rich knowledge resources with the goal of extraction and retrieval of information. Liddy (2001) defines NLP as a theoretically motivated range of computational techniques for analysing natural texts at various levels of linguistic analysis with the aim of achieving human-like language processing for multiple tasks. NLP is applied in the field of computational linguistics, artificial intelligence and computer science. NLP applications rely on Digital Language Resources (DLRs). DLRs are very significant for research and development in the HLT domain for applications in local or indigenous languages. HLTs applications act as a support towards learning foreign or new languages (Mohasi & Dlodlo, 2009; Muhirwe, 2007). HLT also helps to make information technology to be accessible and easy to be used by individuals at various literacy levels. The objectives of this paper is (a) to develop a concatenation-based Sepedi TTS synthesis system that is easy to use and can be integrated into any voice-enabled application system and (b) to promote language diversity and recognition of Sepedi in the ICT sector.

The learning of mathematics by non-native speakers of English creates some essential issues when a second language is used as a language of instruction in institutions (Cuevas, 1984; Keeves & Darmawan, 2007). As such, linguistic skills are required to be mastered by non-native speakers when learning mathematics. Since students who are known as English Learners (ELs), or who are bilingual are from non-dominant societies, they require access to instruction, curricula, assistive technologies, and teachers who are proven to be effective in aiding academic achievement for ELs population. A multilingual place like Limpopo Province in South Africa is having more than six different languages namely Sepedi, Tshivenda, Xitsonga, isiNdebele, SiSwati and English, of which the majority of people speaks three of those languages. Hence, the output of this study may be helpful for people who are learning Sepedi.

According to Krauwer (2003), under-resourced languages refer to a language with some of the following features: limited presence on the internet, little or no information technology available, shortage of linguistic expertise, and shortage of electronic resources for both text and speech processing. The same concept is also called scarce-resourced languages, low-density languages, and limited-data languages (Besacier, Barnard, Karpov, & Schultz, 2014). Some scarce-resourced languages are spoken by a very broad society and literally official languages of their country. But some minority languages may be treated as well-resourced languages. Therefore, scarce-resourced languages are definitely at risk and at the same time

the converse is still true. Nowadays, computers are extremely used to exchange information by means of speech and text. Text processing tools, electronic dictionaries, and enhanced speech processing systems like speech synthesis and recognition systems are accessible for several well-resources languages.

In this world of digital age, every individual demands computational systems should act like humans. The growing significance of ICTs in our communities has highlighted the need for HLTs. HLTs make it possible for computer systems to use spoken language to interact with human (Litman & Silliman, 2004). These technologies make it simple for humans to communicate with machines, and this can assist the industries and government to make products, services and information accessible in any language[2]. HLT has an important task to participate in adjusting the historical discrimination opposed to specific languages.

Theoretical Background

Modular architecture for research on speech synthesis (MARY) TTS (Schröder & Trouvain, 2003) is an open-source, multilingual TTS Synthesis platform written in Java. It was originally developed as a collaborative project of Language Technology Lab from the German Research Centre for Artificial Intelligence (DFKI) and the Institute of Phonetics at Saarland University. It comes with toolkits for adding support for new languages and for building Hidden Markov Model (HMM)-based synthetic voices and unit selection voices. There are also similar research endeavours underway at the HLT division of Meraka Institute of the Council for Scientific and Industrial Research (CSIR) to improve the naturalness of synthetic speech. Speect is a multilingual TTS synthesis system developed at the Meraka Institute for the eleven South African official languages (Louw, 2008). Speect is used to build multilingual TTS synthesis systems for new languages in a similar manner the Festival TTS system (Taylor, Black, & Caley, 1998) has been and is used to build voices for new languages.

Unavailability of TTS synthesis systems leads to difficulties in learning foreign or new languages. According to Lewis, Simons, and Fennig (2015), there are more than 6900 languages in the world and only a small number provides the materials needed for development of HLTs. Hence, HLTs are normally related to well-resourced languages. Unfortunately, most languages from developing countries such as South Africa and other African countries received small awareness so far. An important way of promoting language diversity for our indigenous African languages is to focus on conducting research on HLTs for multilingual applications, specifically for under-resourced languages.

Assistive technologies for disabled people are showing a fast growth, providing important tools to support daily activities. Speech synthesis system is one of the assistive technology that enable people with disabilities to accomplish independence in terms of mobility, and to help them to access the tools of information technology. In the study of Mekhalfi et al., (2016), a system prototype was developed to aid visually impaired people with navigation and recognition of objects in indoor environment. The system comprises speech recognition and synthesis interface to interact with the user. TTS synthesis systems benefit users for

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[2] http://www.csir.co.za/meraka/hlt/docs/hlt_booklet.pdf

different applications. Upon establishment of TTS synthesis systems, users get several potential applications such as (Mulat, 2013; Singh & Verma, 2013):

a) Telecommunications services: TTS synthesis systems allow textual data to be accessible via telephone (Sluijter et al., 1998).
b) Multimedia, HCI: Implementation of high quality TTS synthesis systems enhances interaction between humans and computers (Mohasi & Dlodlo, 2009).
c) Applied research: TTS synthesis systems have a special feature which makes linguists to develop many applications that support different languages (Pammi, Charfuelan, & Schröder, 2010)
d) Support for mute or visually impaired people: Voice impairment originates in mental disorders or accidents.
e) Language learning in education: TTS synthesis systems can be implemented in Computer Aided Learning systems to supply an assistive tool towards learning a new language (Israel, Marino, Delisio, & Serianni, 2014).
f) Talking toys: "Speak and Spell[3]" is the first speech synthesis toy which was developed in the 1970s.

TTS synthesis systems are becoming increasingly more commercially available in the market. Most systems use concatenation method to produce high quality natural sounding speech waveforms. Some systems use HMM speech synthesis system (HTS) (Tokuda, Heiga, & Black, 2002) approach to quickly produce speech waveforms at high speed. The problem of HTS is the robot-like low quality of the speech waveforms. Some available top commercial high quality TTS synthesis systems are: Acapela[4], IVONA[5], Loquendo[6], AT&T Natural Voices[7], Cepstral[8], CereProc[9], NeoSpeech[10] and Lumenvox[11] TTS demo.

Methods

In recent years, concatenation-based TTS systems are used widely by commercial companies to produce speech-enabled applications. In concatenation-based TTS systems, phones units are retrieved from a speech database and then concatenated together to output a speech sound as shown in Figure 2. The speech database contains recorded speech units of various sizes. The major module of the concatenation-based TTS system is the unit selection module; whose main purpose is to choose the series of speech units in order to generate high quality synthetic speech. The methodology followed in this paper is as follows:

a) Input text phase as shown in Figure 3: the user enters the numeric numbers and mathematical symbols into the textbox. This phase first analyses the positions of the numbers and arithmetic signs.
b) Text normalization/analysis phase converts numbers and symbols to their word form.

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[3] http://www.ti.com/corp/docs/company/history/timeline/eps/1970/docs/78-speak-spell_introduced.htm
[4] http://www.acapela-group.com/voices/demo/
[5] http://www.ivona.com/
[6] http://www.nuance.com/for-business/by-solution/customer-service-solutions/solutions-services/inbound-solutions/loquendo-small-business-bundle/interactive-tts-demo/index.htm
[7] http://www.wizzardsoftware.com/text-to-voice.php
[8] http://www.cepstral.com/en/demos
[9] https://www.cereproc.com/
[10] http://www.neospeech.com/
[11] http://www.lumenvox.com/products/tts/

c) Unit selection phase: word-based concatenation synthesis is used to generate high quality synthetic speech; it involves recording sentences of real speech, segmenting these sentences into unit words, and then stores them in a speech database.

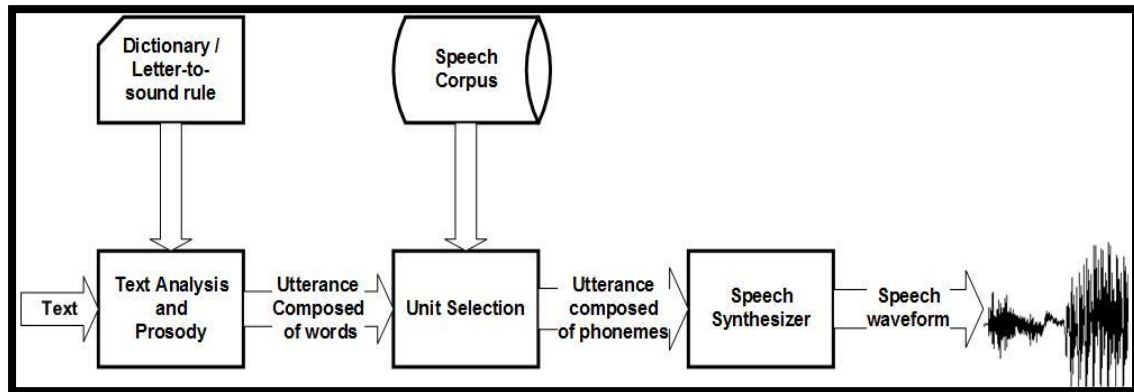d) Speech synthesizer phase: unit segments are concatenated together to produce the desired speech output.

Figure 6: Block diagram of concatenation synthesis system

e) The speech corpus consists of two fields: word and filename fields. The word field contains the word and the filename field contains the sound file location. The database preparation contains selections of words and their combinations. A light weight SQLite Database Management System (DBMS) was used as the speech database.

f) A word can be searched in the speech database to retrieve the filename which contains the location of the sound file; then retrieves the corresponding sound file in the application resources. Finally, the searched words are concatenated together to produce the synthetic speech corresponding to the inputted text.
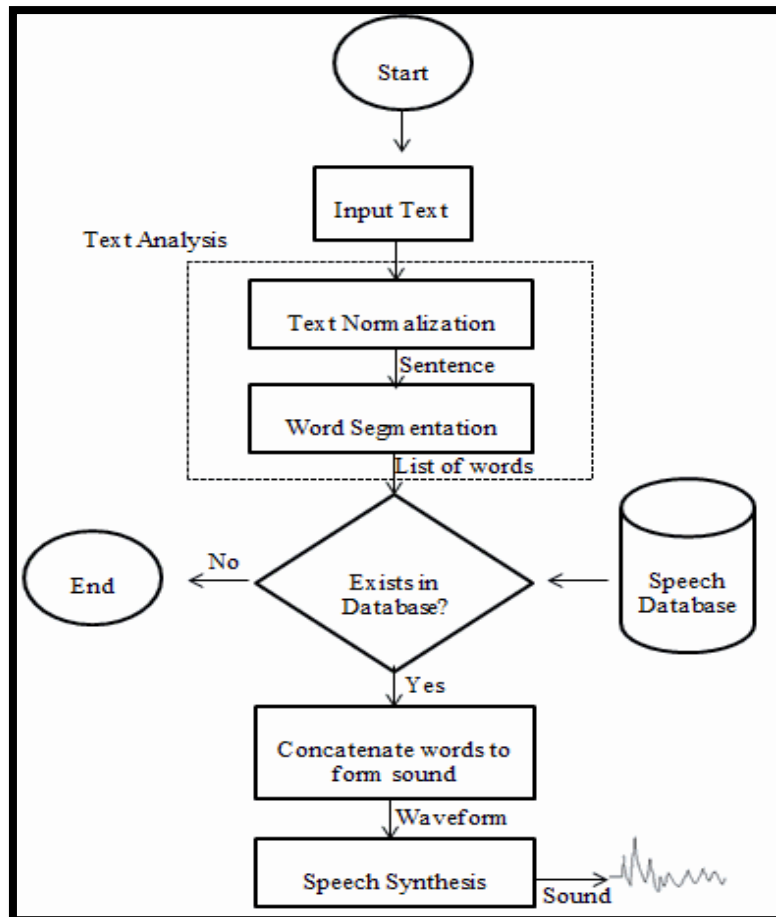
Figure 7: Flow chart diagram of the proposed system.

Implementation of the TTS Synthesis System

Android mobile system was selected for development of the application. This was due to android usage popularity. The minimum operating system specification requirements for implementing Sepedi TTS is Android OS version 2.3.6 also called Gingerbread. For the implementation of this TTS system, words were selected as the basic unit of concatenation. The main reason for selecting words as basic speech units is because the quality of the synthetic speech is more natural.

Recording of words

The words were recorded by a native male speaker of Sepedi. To produce the best quality of synthetic speech, the following parameters were set during recordings; channel = Mono, Sampling rate = 48000 Hz, and Bit Depth = 16 bit.

Text Normalization

The speech synthesis text normalization module consists of analysing input text before passing the text to speech synthesizer. The input text contains numbers and some mathematical symbols. Both were expanded to their word form, such that the synthesizer can generate synthetic speech in word form.

Graphical User Interfaces

The system allows numeric values and some mathematical symbols as input. When the 'Speak' button is clicked as shown in Figure 4, the application computes the answer and produces the speech waveform corresponding to the text and plays the audio.
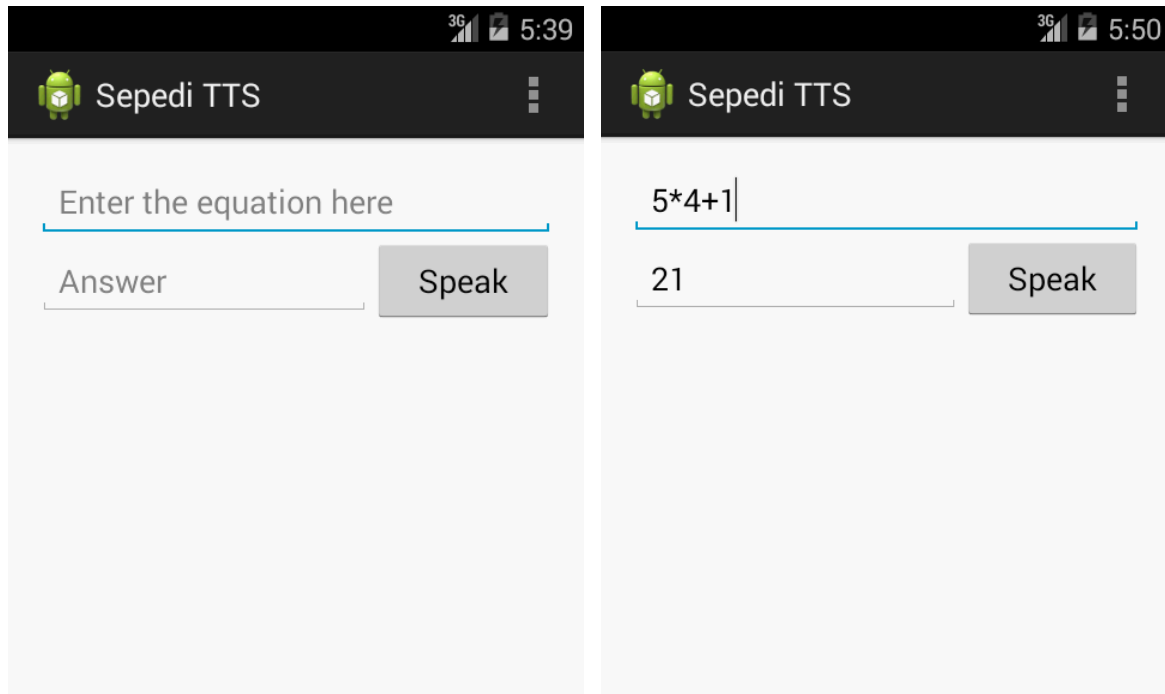
Figure 8: Graphical user interfaces for Sepedi TTS application.

Evaluation Procedure

This section describes the procedure that was used for evaluation of the TTS synthesis system. To evaluate the output of synthetic speech, a 6-point modified Mean Opinion Score (MOS) rating system was adopted from (Viswanathan & Viswanathan, 2005), where 6 meant "best" and 1 meant "worse". MOS rating systems have been proven to be reliable evaluation technique for opinion tests. The evaluation of the system was adopted from (Rousseau & Mashao, 2005). The following questions were asked:

a) How much listening effort is needed to understand what was said?
b) How pleasant is the voice you heard?
c) How natural is the voice you heard?
d) Overall impression of the system

A sample of ten students composed of 8 natives and 2 non-natives of Sepedi from University of Limpopo were used to evaluate the system. Evaluators listened to the following six equations in Sepedi:

a) $200 + 26 = 226$
b) $31 / 10 = 3.1$
c) $4 * 4 = 16$

d) 999-9 = 990
e) 5 < 10 = True
f) 20 > 30 = False

All equations played once, then evaluators were asked to give their opinions by rating from 1 to 6. The score for each question were averaged and the results are discussed on the next section.

Experimental Results and Discussion

The evaluation categories used for the MOS method were: intelligibility, pleasantness, naturalness and overall system impression. All the subjects found the system easy to understand. Eight (80%) subjects found the system very satisfactory to listen to while one (10%) subject found the system unpleasant. The evaluation results revealed that three (30%) of the subjects found the system very natural, and five (50%) of the subjects said the system is natural, while two (20%) of the subjects said the system is unnatural. On average, the evaluation results indicate that the overall system impression was found to be good. Only four (40%) of the subjects said the system was excellent.

Table 1 shows the results of the evaluation procedure. According to Table 1 the system has:

a) A mean intelligibility of 4.9. This conveys whether the right message sent or not.
b) A mean pleasantness of 4.2. This result is dependent on voice used for creating the system. This can be improved by using professional speaker.
c) A mean naturalness of 4.7. According to MOS ratings this shows that the synthetic speech is natural.
d) A mean overall of 5.3. This proves that the system received 100% acceptability rate.

Table 5: Mean Opinion Score ratings of the system

Question	MOS	Meaning
Intelligibility	4.9	Minimum effort required
Pleasantness	4.2	Above satisfactory
Naturalness	4.7	Natural
Overall	5.3	Good

Several evaluators commented on the quality of the synthesized speech. Speech quality remains a concern in speech synthesis systems. Speech quality and voice clarity are very important to speech synthesis systems and it should be the main aim of what every speech synthesis system designer should achieve.

Conclusion and Recommendations

In this paper, we discussed the development of TTS synthesis system for Sepedi. This paper is intending to deliver a domain-based concatenation TTS synthesis system for Sepedi that is intelligible, pleasant and naturally sounding. As people continue learning and using English

on a daily basis, our indigenous under-resourced languages 'dies'. This system can be used as a learning tool to aid leaners to understand the language of mathematics in their first-language and other languages as well. Teachers can adopt new techniques when teaching mathematics, flipped classroom approach can be used in the learning of mathematics as it is recommended by Charles-Ogan & Williams (2015). Hence, this study makes it possible to promote language diversity of indigenous languages of South Africa in the ICT sector, thereby preserving the heritage of these languages. The future work will be focussed on improving the synthesizer to synthesise any text in Sepedi, to improve the quality of synthesized speech, and to improve the system to support more indigenous languages of South Africa.

Acknowledgment

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