International Journal of Educational Studies
ISSN: 2641-533X
Vol. 5, No. 2, pp. 27-87.
2022
DOI: 10.53935/2641533x.v5i2.246

Smart Board use and Pedagogic Practices among Educators: A Case of a South African Township School

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ABSTRACT: *The purpose of this study was to understand the state of smart board use and pedagogic practices among educators in a township school. Four educators participated in this case study-based research project. The study established different means in which smart boards have become central in the teaching and learning processes within the township schools. It was found that educators used the smart boards for writing, downloading and uploading multiple tasks. It was further established that smart boards were making teaching interesting. In this regard, smart boards were found to equally make teaching easier in many ways. The smart board use was however found to face challenges such as resistance especially from senior educators, technical challenges such as freezing and the challenge of load shedding. The research however concluded that despite the challenges, smart boards remained an important source of ensuring transformative and pedagogical oriented teaching and learning as well as enhanced teaching and learning in poor settings such as townships. Equally, a holistic approach that targeted key aspects of schooling such as technology and educators was used to understand how new technologies such as smart boards especially for township contexts could be drawn upon in enhancing teaching and learning. A qualitative research methodology was used in which in-depth interviews as well as observations were used for data collection. The social constructivist approach was used in the discussion of the findings. This approach aided in exploring the educator practices and opinions regarding their use of smart board technologies in various subjects.*

Key words: *Hardware, Information and communications technology, ICT pedagogy, Smart boards, Software, Technology.*

1. Introduction

Following the fall of apartheid in 1994, South African education has undergone significant changes which particularly aimed at transforming what was fundamentally an unequal system (Van Zyl & Sabiescu, 2016). Importantly in their argument is the view that changing the teacher's pedagogic practices to those required for teaching and learning in the 21st Century has been one of the most irrepressible challenges (Van Zyl & Sabiescu, 2016). There is also no denial that the unequal education system under apartheid has left a huge infrastructure and teacher competency gap for schools in poor backgrounds such as townships and rural areas (Barlow-Jones & Van Der Westhuizen, 2018). It follows that the infrastructure gap can be understood from an apartheid legacy point of view, and poor planning by the post 1994 government. A combination of these two, and other factors, has presented challenges to efforts by the government to transform the education system. Challenges with the transformation of the education system have in particular been apparent in the government's recent programme of introducing smart board technologies. Despite this, there are deeper issues with infrastructure, such as electricity and internet connectivity, for some poorer areas and townships.

It is also important to note that education, just like other fields in post-apartheid South Africa has not been spared the need for transformative practices. An important part of this transformation process in particular for poor areas such as townships and rural areas has been through the implementation of a combination of infrastructure and human development projects (Momani, Alshaikhi, & Al-Inizi, 2016). The infrastructure part

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Volume 5, Issue 2, pp. 27-87.
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DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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has seen a roll out of information and communication technology (ICT) across the provinces. Momani et al. (2016) further also argued that the introduction of technology, and communication in particular, at secondary school level has exposed the inadequacy of conventional methods in getting students involved and engaged in their education. This is despite the fact that conventional methods have historically formed an important basis for the pedagogic practices for education.

Whilst the expansion of technology use in South African schools is undeniable, it can equally be argued that the growth in the use of ICT has been uneven, especially following the infrastructural and skill inadequacies featuring in rural and township schools (Barlow-Jones & Van Der Westhuizen, 2018). These authors further argue that the persistent poverty and inequalities inherent in townships and rural areas are not only reflected in the schools within these communities but they have also compromised efforts of successfully rolling out the needed infrastructure and technologies. Despite the aforementioned challenges, a significant proportion of township and rural schools have received diverse technologies (Van Zyl & Sabiescu, 2016). It is, therefore, within the context of such efforts that this study focuses on the use of smart boards and associated pedagogical practices in a township school in South Africa's Gauteng Province. Such an approach is key in this study not only because of its importance in making it possible to comprehend how educators in these school settings use technology for teaching but to also understand the challenges the educators face as well as strategies they use in dealing with the challenges. It, therefore, becomes important to explore how educators' experience smart board technologies and to understand the pedagogic practices related to the integration of technology into teaching and learning.

According to Van Zyl and Sabiescu (2016) smart boards have the potential to develop teaching and learning through enhancing multimodality, flexibility, interaction, pace and dialogue. Having recognised this educational potential, the Gauteng Department of Education (GDE) introduced smart boards to 375 schools in Soweto after the initial phase one of what they termed a "paperless classroom" which saw seven schools in the province move from using traditional learning tools to smart boards and tablet devices (Walaza, Loock, & Kritzinger, 2015). The first phase featured infrastructure upgrades and re-equipping school buildings and preparing the classrooms for the installation of the technology. Smart boards have been hailed for serving as a platform for improving teaching and learning in schools. Despite this positive contribution of smart boards, Walaza et al. (2015) also argues that introduction of technology by the GDE is a good start though technology cannot be a magic bullet to all the problems in the schools. This implies that a holistic approach is the most preferred. It needs to be argued, however, that despite technologies such as smart boards not being a panacea to all challenges faced in school education, a study such as this remains crucial due to its focus on exploring the state of smart board use and related pedagogic practices in township contexts.

1.1. Background

Since the 1970s, the changes happening in the field of information technology have impacted on educational practices. In this regard, Momani et al. (2016) argue that the latest developments in diverse fields have had significant influences on teaching especially in relation to the use of technology and communication. These developments can be understood within the context of digital literacy gaining traction in usage across the globe (Beetham & Sharpe, 2007). According to Merchant (2007) digital literacy refers to the study of written or symbolic representation that is facilitated by new technology. In essence, digital literacy has had many implications for teaching and learning in schools particularly with respect to the capacity for new technologies to getting learners involved and engaging with their education. Digital literacy therefore presents an opportunity for challenging conventional teaching methods as they have been highly depended on rote learning, a memorisation technique grounded on repetition (Momani et al., 2016). Momani et al. (2016) further argue that the conventional methods therefore tended to be limited as they have overly focused on theoretical aspects and less on the practical aspects of learning. The quest for embracing digital literacy can be further linked to the view commonly shared by researchers who have noted that quality educational goals can be achieved through new technology driven by developments of educator and learner engagements in both learning and information sharing in general (Shenton & Pagett, 2007).

When it comes to the South African basic education context digital literacy has not only undergone rapid expansion but it has also taken various dimensions. It follows that the White Paper 7 of the Department of Basic Education (2003) also reiterates that through implementation of Information and Communication Technology (ICT) programs the Government of South Africa has kept the education sector abreast with

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global communication technology. ICT, or information and communications technology (or technologies), refers to the framework and elements that make modern computing possible. ICT is generally understood to refer to all hardware, software, networking elements, applications, and systems that collectively enable people and organisations (such as companies, nonprofits, governments, and criminal organisations) to communicate and collaborate online. Pade-Khene (2018) adds that within the South African context it ought to be noted that despite the opportunities that exist with ICT and citizen engagement, the implementation and realization of technology related initiatives by both citizens and government is by no means easy or uniform. The South African context has large proportions of the population commonly categorized as disadvantaged and not engaged in formal employment. In addition to this challenge a 2015 study established that 33% of households saw no relevance in accessing internet (Walaza, Loock, & Kritzinger, 2015). It is therefore crucial to note that the implementation of ICT programmes in South Africa has been felt differently in diverse contexts with poorer settings such as township schools facing a plethora of challenges and lagging behind the contexts where more affluent schools commonly referred to as model C schools are located.

Li, Garza, Keicher, and Popov (2019) reveal that despite evidence pointing to an increase in the availability of technology in schools, its effective integration into educator pedagogical practices, which relates to educators making use of technology to enhance learners' experiences in the classroom, remains a challenge.

1.2. Context of the Study

Adegbenro and Olugbara (2019) emphasise that in the first decade of democracy the South African government embarked on radical reforms to the apartheid education system. With pressure increasing around the need for transforming the education system, reform efforts in many instances have focused on teaching, teacher preparation, and teacher training which are considered key elements of the education system (Tarling & Ng'ambi, 2016). Tarling and Ng'ambi (2016) also add that while the aforementioned efforts targeted at reforming the education sector are equally important in ensuring requisite changes take place, it is equally important to introduce initiatives aimed at ensuring that educators embrace the new changes. In this regard, it is crucial to support initiatives that require educators to change and adapt or innovate pedagogical practices that integrate emerging technologies into classroom practice for the enhancement of learner performance. It can therefore be argued that it is within the aforementioned background that provincial departments such as the GDE and the Western Cape Department of Education have adopted emerging technologies as part of reform strategies to enhance learner performance in their schools.

Pade-Khene (2018) reveal that whilst it is widely agreed that South Africa possesses a progressive legislative framework, for service delivery, questions have arisen in relation to implementation. Generally, South Africa is faced with educational problems such as poor performance as well as the reproduction of social inequality (Kwenda, Ntuli, & Gwatidzo, 2015). Thus, efforts have been made to address these challenges through introducing Information and Communication Technology (ICT) in schools. The use of smart boards in schools is one such effort that government has rolled out in efforts to meet the needs of learners who have different learning styles.

Tarling and Ng'ambi (2016) further argued that despite rapid changes in the skills required for employment there is concern that in some instances teaching approaches continue to be rooted in 20th Century pedagogies. According to López (2010) a broad range of factors which relate to diverse backgrounds, affect learner achievement and they include the home, school, and classroom settings. Equally, these factors tend to influence teacher pedagogic practices and subsequently the general performance of learners in different learning settings. López (2010) concludes that factors that affect learner achievement such as low teacher content knowledge, unequal educational opportunities as well as poor retention rates and subject choices have put South Africa's education system in a worse position compared to similar systems for middle income countries. The education minister, when discussing the 2015 Matric (final grade) results also expressed concern about the persistent under achievement of learners which she described as a national catastrophe (Tarling & Ng'ambi, 2016).

Smart boards vary in size and can be mobile or fixed on walls. They can also be used to display images from a computer monitor with the surface functioning as a big touch screen (Momani et al., 2016). The set up can consist of a desk-mounted or ceiling-mounted data projector and computer, or it can work on a totally integrated system as in the case of rear projection. The smart board software package also includes tablets. In

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the research school, most of the learners come from marginalised families and cannot afford to buy smart phones and struggle with accessing the internet. Smart boards have helped in broadening access to these technologies. The study has 68 educators and close to 1900 learners.

Nineteen smart boards have been installed at the research school. It also needs to be noted that at this school the use of smart boards and all ICT accessories is monitored by the ICT committee led by a school-based coordinator and GDE external technicians who are consulted whenever there is a challenge. Thus, there is easy access to support. In essence, smart boards are being used by both learners and educators to interact and share information for different subjects. The boards also allow learners to participate during instructional processes as they can touch, draw, write and receive immediate feedback through the learning process.

1.3. Statement of the Problem

Van Zyl and Sabiescu (2016) have argued that ICT is far from being a tangible reality in many local schools in South Africa particularly considering challenges related to availability of resources and infrastructure, access to information and educational opportunities. That being said, it remains undoubtable that a holistic understanding of educator usages and associated pedagogical practices related to smart board technology use in schools is crucial. It can be further added that although the introduction of technologies such as smart boards has had progressive implications for the broader South Africa's education sector, it has come with its challenges especially with respect to township schools. Lack of services in South Africa's poor communities such as rural areas and informal settlements has been particularly alarming (Pade-Khene, 2018). The apartheid legacy has been mainly blamed for inequalities in service delivery which has been manifested through high levels of imbalance in access to resources, infrastructure and social services. It therefore needs to be noted that a combination of the apartheid legacy and poor infrastructure together with inadequate training associated with the township schools becomes central in understanding the state of smart board use including how the educators relate smart board use to pedagogic practices in township schools. It can equally be argued that just as argued by ICT veteran Adrian Schofield quoted by Walaza et al. (2015) the GDE's move to introduce smart boards could have been a better initiative if it was part of a holistic approach. Allegations of a failure to embrace a holistic approach that aims at changing teaching methodologies, teaching culture, the curriculum as well as measurement of learner progress makes a study of this nature important. It is also within this scope that the challenges faced by educators when using smart boards can best be understood together with strategies, they use to deal with the challenges faced on a day-to-day basis.

1.4. Main Research Question

This study investigated the experiences and pedagogic practices of township educators related to smart board use. The study focused on understanding some affordances presented by smart boards, the need for ICT policies on the enhancement of ICT pedagogies in a South African context and challenges associated with smart boards use in teaching and learning. The main focus was to find out how educators have been exploring some ICT pedagogies as part of teaching and learning since smart boards are relatively new in the South African education system. As part of the exploration of the research aims, the following research question is addressed;

What are the experiences and pedagogic practices of township educators related to smart board use?

1.5. Aim of the Study

The aim of this study was to explore the state of smart board use and related pedagogical practices within a township context. This is crucial since educators' experience technologies differently particularly depending on the context that they are in. In this regard, the study explored how educators relate smart board use to pedagogic practices in a township school. It is from this view that the study further engages with some of the challenges that educators face with the smart board technology and how they deal with the challenges encountered. According to Pelgrum (2001) the introduction of the latest technologies is extremely good. It implies that educators can make use of technology to complement pedagogical practices. This is despite the fact that in some instances, educators have to grapple with a deficit in skills and other related challenges. The pedagogies associated with new technologies may lead to the promotion of interactive learning if applied in conjunction with smart boards. They may also empower both educators as well as learners (Al-Faki & Khamis, 2014). Thus, smart boards may bring autonomy in education.

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Article History:
Received: 21 September 2022
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Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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According to Freire (1974) interactive learning can lead to a combination of knowledge acquisition and sharing. This calls for the learning process to be negotiated and dialogic as well as emancipatory. Thus, educators ought to embrace teaching practices that can promote interactive learning instead of relying on the conventional methods that are mainly driven by unidirectional release of information to learners. The interactive approach is supported by Goffman (1983) whose view stress that once individuals for whatever reason come into one another's immediate presence, a critical setting for interaction which is promissory and evidential is promoted. Thus, through the ensuing conversations, social and emotional norms and values could be developed. Above all, a learning community is created, which becomes critical for enhancing emancipatory teaching and learning practices.

Smit (2005) also reveals that there has been some scepticism on whether smart boards improve teaching and learning. The sceptics are said to argue that instead of bringing in significant transformation to teaching and learning, there are indications that smart boards merely reinforce current pedagogies of transmission (López, 2010). It has also been argued that there is a great need for educators to implement the pedagogies that are emancipatory, promote learning equity and problem posing and solving as well as interactive learning for tangible results to be realised from smart board use (Beetham & Sharpe, 2007). In this regard, upon investigating the impact of smart boards in teacher-pupil interaction in the teaching of literacy and numeracy amongst seven- to eleven-year-olds, Smith, Hardman, and Higgins (2006) reveal that use of smart boards does not only promote democracy and leaner centred pedagogies but it was equally established that pace was faster in literacy lessons where smart boards were being used.

According to Henrie, Halverson, and Graham (2015) some educators are usually reluctant to use smart learning due to reasons such as lack of instructional support and little time to research. Thus, ICT committees in schools tend to face the burden of ensuring that educators are encouraged, supported, and monitored in terms of ICT usage.

1.6. Objectives of the Study

In order to achieve the abovementioned aim and to answer the main research question, a number of research objectives were formulated. The objectives of the study were to:

- Assess the experiences of educators regarding smart board use in township schools.
- Understand how educators relate smart board use to pedagogic practices in township schools.
- Examine the challenges that educators face when using smart boards.
- Explore the strategies that educators use to deal with challenges faced when using smart boards.

1.7. Research Approach

In this study, a qualitative approach was adopted in order to find out the state of smart board use and pedagogic practices in township contexts Content analysis was used to reduce and group the content (Tesch, 2013). The approach assisted the researcher to observe educators using smart boards to present lessons and the smart tools which they select from the available applications that were available.

1.8. Research Design

A case study which sought to implore how educators respond to the use of smart boards was preferred during the study (Hesse-Biber, 2010). The study gave the researcher an opportunity to empirically investigate how educators used the smart boards and to express their feelings.

1.9. Population and Sample

Purposeful sampling was used to select 4 educators at the school under study. Out of the 4 educators 3 were female educators and 1 a male educator. The researcher decided to use the case study because it provided sufficient focus for extracting rich information on the key issues related to this study. Because the researcher is working at the same school with the participants, interviews and observations were easily scheduled and travelling costs were not a challenge. The participants consisted of a Mathematics, CAT and 2 Geography educators.

1.10. Data Collection Methods

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Published: 9 December 2022
Copyright:
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Collection of data were done in October 2019. Interviews took place at the convenience of the participants during free periods as well as in the afternoon when learners had knocked off. Observations were conducted at the convenience of the participants during their lessons.

1.10.1. Individual Interviews

Face to face interviews were carried out as a follow up to lesson observations. The interviews were videotaped and transcriptions, coding and categorising was done at a later stage (See Appendix E). Open-ended questions about educator experience, values, challenges, and attitudes towards the use of smart boards were asked (See Appendix D). The process began from introductions focused on the research and the features of the study. This helped in alleviating any forms of discomfort and the development of rapport between the interviewer and the participants. The participants expressed and disclosed pertinent data freely (Fayisetani, 2004). They also pointed out some advantages of the smart boards multimodalities as well challenges.

1.10.2. Observations

After familiarising myself with the participants' timetables an observation guide (See Table 1) was developed before carrying out lesson observation visits. Videos were recorded an analysed at a later stage. The way in which educators used the smart boards helped me to identify different discourses on how educators were using smart boards for the betterment of teaching and learning. However, the method has its own disadvantages. According to Bulmer (1982) participants may prepare to behave in a certain way especially after having been told that they shall be visited in advance. However, the way they behave may sometimes prejudice the outcome of observation.

1.11. Ethical Considerations

Participants were assured that their responses will be confidential (De Vos & Strydom, 1998). They were told that they have rights such as withdrawal of their participation at any given time. Consent forms were given to the school principal (See Appendix B) as well as the educators (See Appendix C) in order for permission to be granted. Also, the researcher sought permission to undertake the study through applying for an ethical clearance letter from the faculty of education. The consent forms were explained first before they were issued to both educators and the principal for them to fill in date and sign. The researcher also disclosed to them that he was carrying out the research in order for me to comply with the university assessment requirements. The participants were also told that feedback was going to be availed to them in the form of the research report and that pseudonyms were going to be used in order to protect their confidentiality. The coded data was going to be kept safely and participants were informed that if any of the data would illegally be accessed the researcher would destroy all of it in order to uphold their confidentiality (De Vos & Strydom, 1998).

1.12. Data Management and Analysis

Data collected through the videotaped interviews and observations were transcribed and analysed through colour coding using ATLAS.ti version 8. This is one of the many computer-assisted qualitative data analysis software programmes that can be used to manage a qualitative research study analysis is ATLAS.ti, which stands for Archiv für Technik, Lebenswelt und Alltagssprache (Archive for Technology, Lifeworld and Everyday Language.text interpretation). According to Creswell (2014) coding is used to identify and classify behavioural patterns of the participants and their responses during interviews.

1.13. Organisation of the Study Data

Chapter 1, introduces the study by presenting an overview of the study focus whilst also presenting the background which is an overview of empirical literature from previous studies. The problem of the study, aim, research questions and objectives as well as the rational are also presented. An overview of the context in which the study is being carried out and significance are also presented.

In Chapter 2, Presents the literature review as well as the theoretical framework within context of the study. Key sections include the state of digitalization and technology use in diverse sectors which includes different contexts; pedagogies related to educator perceptions related to ICT use. The chapter also explores the

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state of smart board use in teaching and learning, ICT policies and practices in South Africa as well as challenges faced in the use of ICT in schools. Finally, the chapter presents the theoretical framework.

In Chapter 3, the chapter explains the research design used in the study. In addition, the qualitative methodology was presented together with reasons why it was chosen. Research methods such as in-depth interviews and observations are also described with the aid of a variety of literature references. Also presented in this chapter are ethical considerations, data analysis methods, and limitations of the study.

Chapter 4, presents the research findings and discussions. The discussions are supported by literature review whilst where possible the theoretical framework is used to interpret the data. The chapter begins by presenting an overview of how the coding was done, and then it presents profiles of the respondents followed by the state of the use of smart boards at schools.

Chapter 5, presents an overview of the study. It consists of the conclusion, recommendations, recommendations for further studies as well as the final word.

1.14. Summary

This chapter presented a brief introduction which outlines the key focus of the study, background which deals with an overview of empirical evidence from previous studies and how it relates to the current study, an overview of the research context which explores the scope of the study; significant of the research which deals with the knowledge gap filling aspect and policy importance brought by the research. Chapter one has also presented questions and objectives, as well as the rationale and the problem being pursued by the study. The next chapter presents the literature review and the theoretical framework.

2. Literature Review and Theoretical Framework

2.1. Introduction

In this chapter a literature review is going to be done. The researcher is going to look into different researchers' views such as benefits of digitalization in teaching and learning, policy practices driving the use of smart boards in South African school and benefits of smart board technologies in teaching and learning. Furthermore, Exploration of smart boards as multimodal tools for lesson instruction Smart boards' capacity to enhance interactivity and conversations in learning are also going to be discussed.

2.2. Benefits of Digitalization in Teaching and Learning-an Overview

The digital era has increasingly come to shape practices in many societies the world over with information and communication technology becoming important not just for the education sector, but for a significant proportion of sectors. Kong, Looi, Chan, and Huang (2017) have indicated that the digital era involves an all-encompassing use of information and technology (ICT) across various sectors of society and life including school education. Chetty et al. (2018) present a The United Nations Educational, Scientific and Cultural Organization (UNESCO) definition in which digital literacy was described as a set of basic skills required for digital media, information processing and retrieval. The United Nations Educational, Scientific and Cultural Organization (UNESCO) seeks to build peace through international cooperation in education, the sciences and culture. ICT is increasingly becoming a popular catalyst across many sectors of the economy like education, politics, engineering, health, astronomy, and even aviation (Spiezia, 2011). With regards to technology use within the education context, Li et al. (2019) have highlighted that over the past decades, technology implementation in schools has been a major reform effort. This has been the case in countries across the globe including South Africa. In this regard, ICT devices are regarded as an important component of teaching and learning, as they have capacity to improve teaching and enhance learning. In this study, use of smart boards within the South African township school context is being investigated. ICT and education are inseparable particularly in the current teaching and learning context. In this manner, Spiezia (2011) adds that ICTs play critical roles in teaching and learning which broadly enhance learner achievement. For Yudt and Columba (2011) ICTs motivate and maintain learners' attention in class. In another account, Eden and Heiman (2011); Stoilescu (2008) argue that some technologies such as computers and by extension one may add smart boards offer available multimedia, simulations, and modelling which can lead students into a process of internalizing knowledge hence improve their understanding of abstract concepts. A broad spectrum of technology use by educators in educational settings across the globe has also been identified (Henrie et al., 2015). Some of the identified usages of technology within the education sector include administration, management, educator

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performance evaluation, and learner assessment. Technology has also been widely used in relation to capturing and processing student grades and learning material; traditional or educator centred instructional practices such as teaching (Li et al., 2019). When it comes to smart board technology, which is of focus in this study, it is essential to understand that the technology can also encourage collaborative learning which may subsequently result in some form of community within the classroom setting. In the case of teaching and learning using a smart board, a community is possible through encouraging meaningful teacher-learner interactions. This occurs through a combination of complex and dynamic teaching and learning activities that are associated with the use of smart boards. Thus, Goffman (1983) argues that what we call community emerges from a complex series of interactions and relationships on which it is dependent for its very existence. One can further argue that through face-to-face interactions, smart board technology can provide learners with an opportunity to share and collaborate with one another whilst equally also getting immediate feedback.

2.3. Policy Practices Driving the Use of Smart Boards in South African Schools

Smart board technology use does not take place in a social and policy vacuum. In South Africa, the smart board technology has been promoted through various policies. Kwenda et al. (2015) emphasise that the South Africa government has tried its best to support, especially public schools that were historically disadvantaged by the Bantu Education Act of 1953 during the apartheid era. The authors' further point to the need to carry out further research with the aim of understanding the pedagogical practices related to the use of technology in South African schools. They argue that such efforts could assist in finding best and equitable strategies for implementing ICTs in schools whilst also ensuring that learners derive optimum benefits through application of ICT skills in teaching learning. The Department of Basic Education (2003) emphasises that e-Education is more than developing computer literacy and the skills necessary to operate various types of information and communication technologies. It is also supposed to be a creative process. It leads to access of resources that are of high quality, diversified and relevant and offer learners presentation of new knowledge opportunities to compliment information that can be acquired libraries and other sources. Through access to ICTs learners also get an opportunity to use different forms of multimedia applications to solve academic problem analyse data and contextually create knowledge. Also in research carried by Miller and Glover (2002) it was established that the use of ICT in education produce positive results.

The South African (Department of Basic Education, 2004) sets out the aims, principles and rationale aimed at promoting e-learning and the general use of ICT in South African schools. The policy notes that, the use of ICT is part of lifelong learning as it affords learners an opportunity to interact with information whilst also providing them with unlimited opportunities for personal growth and development. Bialobrzeska and Cohen (2005) set out guidelines for ICT and stress that ICT should be used for lifelong learning by setting out goals for ICT usage in schools. The policy document also stresses the importance of ICT in management and administration in schools and the significance of using ICT in supporting teaching and learning. Furthermore, through the policy, efforts and guidelines on the implementation of ICT have been put in place.

The Department of Basic Education (2004) further acknowledges that besides the issue of access, there is a gap in the ability of learners and educators to effectively use the provided technologies, to access high-quality and diverse content, to create content of their own, and to communicate, collaborate and integrate ICTs into teaching and learning. Educators also encountered some technical challenges in trouble shooting the smart boards. The department thus, pointed to a need to improve ICT knowledge among educators through professional development. In an effort to implement ICT policies in South African schools, the Department of Education (DOE) initiated different partnerships endeavours. For instance, a partnership with Vodacom has aimed to train more than 1400 educators on ICT skills annually at the nine centres established across the country. The program has been aimed to train mathematics and science educators on ICT related pedagogies in order to enhance learning. In addition, under the "train the trainer" Project which has been initiated by the Internet Service Providers` Association of South Africa (ISPA) many South African rural schools have been benefiting from training on ICT pedagogies since 2001 (Bialobrzeska & Cohen, 2005). However, it was revealed that most of the programs are only aimed at beginners and intermediate computer skills without equipping teachers with the necessary skills to benefit fully from ICT use (Miller, Naidoo, & Van Belle, 2006). Despite some positive changes regarding ICT development and use in South Africa, in particular within the education sector is of much cognisance. In terms of equity, it was also revealed that the use and

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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access of ICT in South Africa is still predominantly in the hands of the rich minority (Department of Communications, 2013). However, it was acknowledged in the National Development Plan (NDP) that the ICT legislatures should be fully reviewed in the short term in order to develop a "new integrated policy" (Department of Communications, 2013). The NDP actually advocates for South Africa to play a leading role in as far as the integration of ICT in the African continent.

2.4. Benefits of Smart Board Technologies in Teaching and Learning

Smart boards have become a common feature in today's classrooms of the information age and many South African schools in urban areas are equipped with interactive whiteboards and other ICT tools for teaching and learning (De Silva, Chigona, & Adendorff, 2016). The study revealed that most of the educators are still sticking to the transmission mode because they were not exploring smart board applications to their fullest. Despite such a low uptake in smart board use in some instances, the technologies have widely come to be part of a daily routine whilst also providing a unique dimension to classrooms by infusing the power of computer technology. According to Momani et al. (2016) a combination of conventional methods and digital literacy may contribute to academic achievement. It can also provide space for enhancing the positive contributions for adopting digital methods in teaching. Verbal as well as symbolic information can be produced and communicated through screen-based texts instead of depending on print media only. Furthermore, use of a multiplicity of methods has led to the development of multimodal media technologies which enable people to use a multiplicity of modes that are audio, print and screen (Ilomäki, Paavola, Lakkala, & Kantosalo, 2016). Technologies such as smart boards have been found essential in teaching and learning. The study revealed that smart boards are consequently beneficial in the classroom setting as they allow for the sharing of thoughts and experiences. Furthermore, the sharing of the thoughts and experiences can occur among the educators themselves something that can enhance their skills and knowledge for the good of the broader teaching and learning process. Good educator–learner relationships can thus be developed through ICT. Thoughts and experiences related to smart board use can be shared in a relational way that is not one-sided but that provides for a fluid exchange between different parties. This can be the case between an educator and learners or among educators sharing experiences on pedagogic practices related to smart board use. Above all, smart boards can also promote learner understanding of concepts, inter-subjectivity interaction as well cooperation. Use of smart boards can also promote a shift from one's usually way of handling issues to embrace other means that may be helpful (Bingimlas, 2009). Furthermore, cross cultural competence can be promoted. In addition to the aforementioned of ways in which smart board technology is beneficial in education spaces, educators and other stakeholders have used these technologies differently with diverse levels of competencies being displayed (Li et al., 2019). These authors have also reported that in terms of smart board technology use among educators, those with similar levels of proficiency may also vary in the way they use it. For example, in the present study some educators use smart boards solely for displaying content whilst others use the boards for the facilitation of learner assessment, group work and relating visuals to reality. Educator pedagogical practices and perceptions emanating from their experiences with smart boards usually reflect the type of technology that educators use in their teaching. Li et al. (2019) have argued that educator perceptions on technology and related pedagogical practices are dependent on a wide range of factors. They have indicated that these factors include type of technology, the identity of the educator and learners involved together with policies and practices. This also includes the school environment in terms of infrastructure development something that is dependent on its location. In a related view, Momani et al. (2016) have added that successful utilisation of technologies by educators within teaching and learning processes may depend on various factors that include students; perceptions, physical conditions, costs, school management, and general pedagogic practices employed.

López (2010) has also revealed that for successful technology integration, the educator ought to display skills of being innovative. In this way, the educator can be in a position to play a critical role in ensuring pedagogical transformation related to the use of technology in their teaching. Mikre (2011) asserts that smart boards make learning less abstract by explaining complex concepts through a variety of resources such as visuals on screens. Smart boards can also lead to active learning, increasing learner engagement; encourage creative and collaborative learning, increasing the learning pace, and making learning less static than through conventional methods such as using textbooks or the conventional white boards. Above all, by using smart

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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boards' technology, learners may use different forms of multimedia applications to solve academic problems, analyse data, and contextually create knowledge.

It can therefore be argued that, access to internet through Wi-Fi greatly widens the pedagogic space particularly as it becomes easier for both the educator and learners to access more resources as well as to interact and do more learning on line. In support of the view that smart board are pace setters in teaching, Moss et al. (2007) emphasise that the use of PowerPoint and flipcharts through screens aid lesson pace. They add that pace setting also occurs when the educator pre-plan, preloads and moves between various linked materials that are presented on the smart boards. Since visuals and videos together with other related features of smart boards promote interaction and arouse learner interest, such a state can be linked to the social constructivist approach, particularly its emphasis that during its development, technology is not only driven by problem posing, it is socially shaped just like any human made relic (Njenga, 2018). Al-Faki and Khamis (2014) also stress that when learners pose problems, they get motivated in learning and real-life problem solving. This can further lead to innovation as well critical thinking among learners. Above all, besides technology being a social construct, the interests and other teaching and learning practices that have come with smart boards concur with the social constructivist approach especially where the approach indicates that at any given time, technology reflects the needs and interests of the creators and the meanings contained in the diverse socio-cultural contexts where it is located (Njenga, 2018; Van Zyl & Sabiescu, 2016). It can further be argued that through smart boards, learners may be able to respond and receive immediate feedback. The learners are also given an opportunity to interact with each other, something that enhances learning and skill acquisition. Thus, educators may use ICT artefacts such as smart boards to encourage interaction. These artefacts can also be used as scaffolds in connecting the less academically talented learners to the more knowledgeable ones as also suggested by McCown (1999). Learners can also have an opportunity to engage in dialogues in the form of activities such as quiz and debates with smarts boards being used as a point of reference and to present instructions and any relevant material. Most of the smart board benefits discussed above have been highlighted in the study especially during lesson observations.

2.5. Exploration of Smart Boards as Multimodal Tools for Lesson Instruction

Although there are reports that smart boards are being underutilised by educators in many instances their usage as multimodal teaching tools has been widely reported. In this way smart board technologies have proved to be a key part of teaching and learning. Multimodal technologies, both visual and written texts, have made communication easy and convenient within the knowledge society. The aforementioned arguments on multimodality corroborate the view of Maher (2012) who has argued that smart board multimodality provides students with an opportunity to experience a platform that enables them to share ideas and modify or combine them to create something better. In addition to being interactive in nature, the smart boards develop learner interest and lead to development of user-friendly paperless classrooms. In addition to researchers having also discovered that classroom interaction may be achieved through the multimodal use of smart boards, Mdlongwa (2012) has argued that learners may be given an opportunity to interact using smart board related technologies such as the stylus pen which usually increases their problem-solving urge.

The argument of the multimodal nature of smart board technology can be further explained by the view of Moss et al. (2007) who have elaborated that how knowledge is represented, as well as the mode and media chosen, entails a crucial aspect of knowledge construction, making the form of representation integral to meaning construction and learning in particular. That is, the ways in which something is represented shapes, both what is to be learnt, that is, the curriculum content, and how it is to be learnt. It follows, then, that to better understand teaching and learning in a multimodal environment such as the one prevalent in contemporary classrooms smart board technologies ought to be viewed as presenting educators with an opportunity to draw from the multiple applications that come with the technology.

2.6. Smart Boards' Capacity to Enhance Interactivity and Conversations in Learning

It can be argued from the study, that interactivity associated with smart board use within a classroom setting and the linkage of the multiple applications to real life situations is usually accompanied by use of diverse languages and multiple conversations. Magano, Mostert, and Van Der Westhuizen (2010) points out that conversations associated with teaching and learning are not just a language but an interactive art of communication through gestures, facial expressions and variations in tone of voices. Thus, teaching and

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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learning can be enhanced when each participant's voice could be heard. Magano et al. (2010) also argues that creation of knowledge can also be improved through turn taking, listening, and togetherness and sharing of ideas. Thus, an opportunity to share ideas and opinions can be created through conversations. It can further be argued that learning is not limited to the formal curriculum as infusion of some social activities into learning can also be enhanced through classroom conversations. Magano et al. (2010) furthermore, take the issue of conversations further by claiming that they can promote interaction by creating an opportunity for learners and educators to share some ideas. In addition, Magano et al. (2010) also reason that research has proved that interactive learning and associated conversations play a fundamental role in the learning process globally. The conversations are also said to have potential to be more meaningful, enjoyable whilst also providing substantive benefits which include social change to both educators and learners.

Magano et al. (2010) further elaborate those conversations within the education setting can facilitate building of communities when people communicate through greetings, interaction, talking, and sharing their interests and family related issues. Thus, conversations are an essential component of interactive learning. The issue of interactive learning can also be explained through the constructivist approach where relations can be interpreted as closely related to socio-cultural explanations where holism and contextuality are embedded. In this regard, interactivity and involves the creation of social meanings related to the emergent relations that emanate from the way learners and educators experience smart board technology. In addition, access to the smart tutor application associated with smart board use a has become central to the transformation of teaching and learning as it allows an integrated combination of interaction, use of visuals and listening through videos.

According to Gillen, Staarman, Littleton, Mercer, and Twiner 2 (2007); Preston and Mowbray (2008) a smart board is described as a large computer screen with touch sensitive, full colour display on which both the educator and pupils can write their own text, call up text and images from their hard disk, access internet or intranet and run a range of specifically designed curriculum related software and partially completed quizzes. In this regard, smart boards contribute towards learner motivation (Magano et al., 2010).

In addition to learner motivation, Chetty et al. (2018) stress that contributions from a combination of conventional and digital technologies enhance student interaction and has a positive motivational effect on learners. Such a combination of technologies also presents a diversity of materials that an educator can draw from, which places the educator in a more effective position to assist learners. The flexibility of the smart board, with a combination of conventional and digital technologies is shown in different figures.

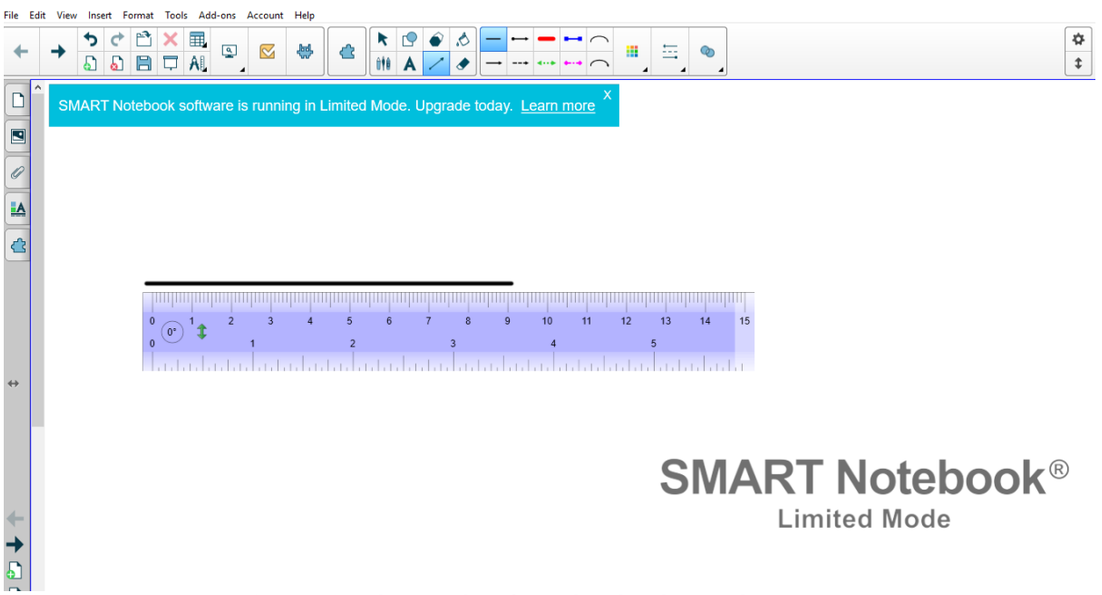


Figure 1. Sample screenshot of smart board mathematical instruments.

Figure 1 exemplifies how measurements can be done using a ruler on a smart board.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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The flexibility of the smart board, where for instance, it can be used in dealing with different concepts and subject matter is shown in Figure 1. By incorporating the use of the ruler on the smart board as reflected by the figure, this exemplifies how measurements can be done using a ruler on a smart boarder.

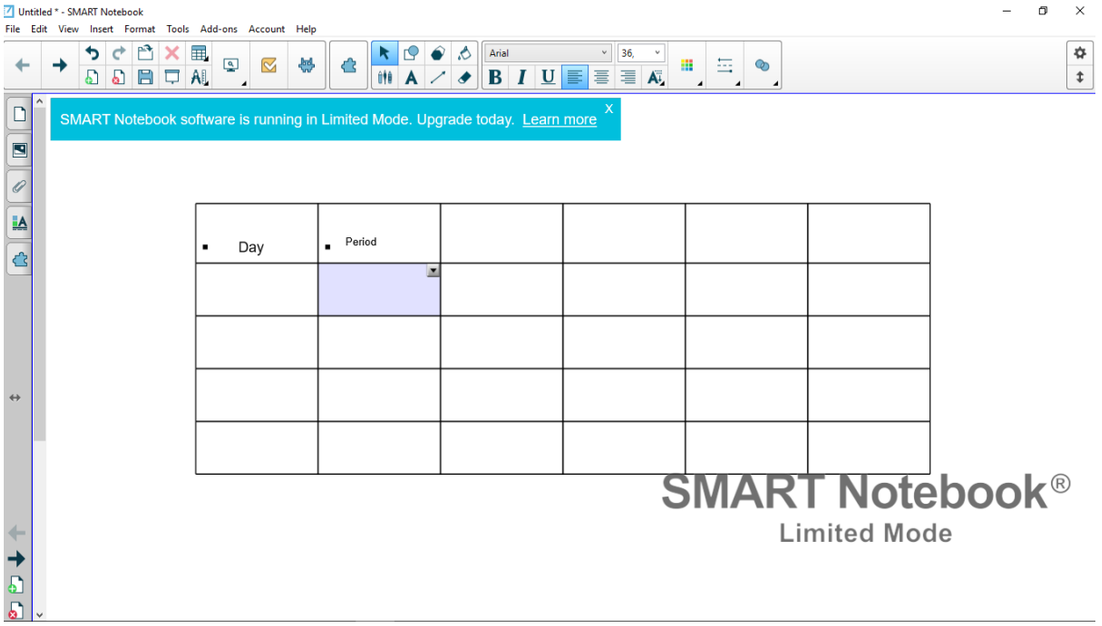


Figure 2. Sample screenshot of how to insert a table on the smart board.

Figure 2 shows how the flexibility of the smart board where illustrations such as tables can also be added onto the smart board to aid teaching.

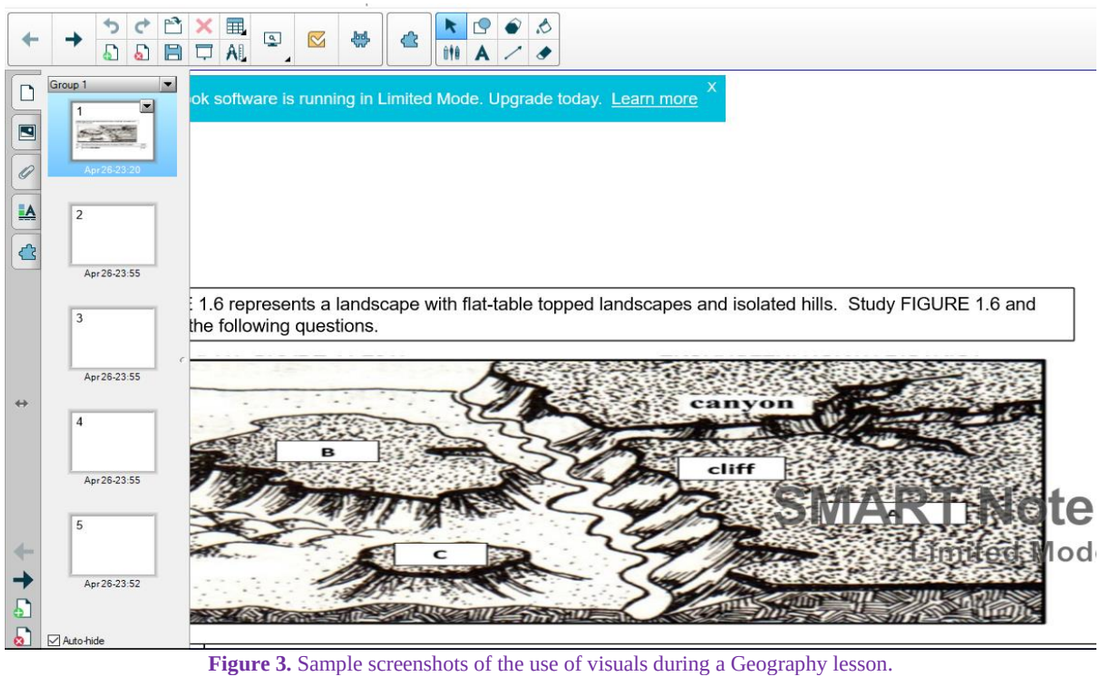


Figure 3. Sample screenshots of the use of visuals during a Geography lesson.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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Figure 3 shows an example of PowerPoint which is a way of presenting work through slides. The visuals shown in Figure 3 highlight how existing illustrations such as maps can be uploaded onto the smart board in subjects such as Geography, something that helps learners connect the visuals with reality. In this manner learning is enhanced. In addition to having learning materials saved on the smart board and augmenting learner interest, creativity, and imagination is also enhanced (Momani et al., 2016).

According to López (2010); Mikre (2011) smart boards also make learning less abstract by explaining complex concepts through a variety of resources. This enhances active learning, learner engagement, creative and collaborative learning, learning pace as well as innovativeness into learning. Furthermore, smart boards also allow educators to easily accommodate individual learning, and help learners to understand the content deeper (Maninger & Holden, 2009). The use of ICT, therefore, consists of an important part of learning that affords learners an opportunity to interact with information and use higher order thinking such as comprehension and reasoning (Webb, 2002).

In other research it was found that the use of interactive whiteboards in classrooms positively impacts on the motivation and engagement of not only the learners, but the educators as well (Hodge & Anderson, 2007). This means that there is two-way interaction in the classroom. In Miller and Glover (2002) study of three schools that integrated interactive whiteboards, the school with the most success was one that supported all educators with professional development on how to use digital technology infrastructures. Al-Faki and Khamis (2014) also state that smart boards serve both educators and the learners in that they increase learners' participation as they interact with different materials on the board and software such as microblogging, which may not be done with other ICTs. Furthermore, Al-Faki and Khamis (2014) argue that when smart boards are integrated in the classroom, they bring several advantages to educators as well as learners. Digital technology infrastructure, particularly in the form of smart boards, has the potential to foster a more flexible, learner-centred notion of education that facilitates the soft skills vital for new demands of the 21st- century global service and information economy (Livingstone, 2012).

According to Xin and Sutman (2011) use of smart boards can increase scaffolding and collaboration amongst learners whilst also assisting with accommodating diversity within a multicultural classroom. Using multiple approaches to tasks through smart boards particularly due to its contextual nature is equally believed to encourage social interaction (Smith et al., 2006). This interaction takes the form of mediation, dialogue as well as negotiation. In this way, smart boards can also be used to deal with learning barriers such as time, resources as well as long distances that learners have to travel to school in poor settings in particular. Also, interactive learning can lead to mediation of processes during teaching and learning thereby promoting emancipation by connecting educators and learners. Biesta (2012); Koschmann (2013); Churcher, Downs, and Tewksbury (2014) assert that mediation using technologies as well as semiotic tools and related social interactions leads to the development of higher mental functions.

2.7. Experiences and Pedagogic Practices of Educators Related to Smart Board Use

Smart boards as a form of technology commonly used by educators particularly when it comes to pedagogic practices became a noticeable feature among the educators. Not only did the educators highlight the importance of the technology, but they also elaborated the fact that since the smart board technology allows for internet connectivity, teaching can be easily done through a variety of practices such as uploading videos and worksheets which the learners can access whilst they are at home or anywhere convenient. In essence, teaching can continue taking place even in the absence of the educator.

Adegbenro and Olugbara (2019) present the view of Pierson who through a case study on how technology integration promotes pedagogical expertise found evidence of technology use being related to instructor's teaching expertise. In this regard, he advocated for the need to ensure that educators who can effectively use technologies to benefit learning and skills development are supported in that endeavour. Equating this study to smart board technology has also shown that embracing technologies such as smart boards equally assist learners to have a capacity to develop some critical thinking in particular due to the exposure to ICT pedagogies that are educator driven. According to Diemer, McWhirter, Ozer, and Rapa (2015) educators need to use pedagogies that can allow learners to be free and be in a position to enquire about what they do not know or have not understood from the educators. The educator's choice of pedagogies should consequently allow flexibility whilst being varied and holistic in nature. Freedom to interact during teaching and learning is therefore very important. Furthermore, Churcher et al. (2014) elaborate that use of technology in the

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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classroom presents educators with a myriad of options that have previously been unavailable under the era of conventional methods.

Dialogue has also been found to be an essential component of educator pedagogical practices in particular when it comes to critical learning practices. In clarifying the nature of dialogue related to educator pedagogies, Freire (1974); Giroux (1983); Giroux (2010) hinted that dialogue should not be taken as a way of imposing ideas onto learners but as an exchange of ideas by the discussants. According to Donnelly, McGarr, and O'Reilly (2011) educators should undergo a process of restructuring through developing shared meaning in the change process that involves embracing ICT related pedagogies. Also, sometimes educators feel a lack of ownership of the curriculum which discourages them from engaging in new pedagogies. Such a position can led to a situation whereby educators end up imposing ideas onto the learners. However, Freire (1970) claims that instructions are also sometimes necessary. In a pedagogical oriented context, learners are expected to take over and expand from what the educator might have introduced. This might only be achieved using ICT gadgets such as smart boards in conjunction with other accessories such as learner tablets or smart phones. It is therefore crucial to understand diverse pedagogical related experiences and practices of educators with ICT especially within a township context.

It is also critical to understand how effective use of ICT related pedagogies could be linked to innovation and constructivism. Al-Faki and Khamis (2014) argue that most South African educators do not give themselves time to research and prepare lessons that are empirical in terms of learner background and ICT pedagogy usage. Thus, different pedagogies can be explored to understand the state of smart board use and pedagogic practices among educators in township schools as part of enhancing liberatory and emancipatory pedagogical practices. There is therefore a great need to explore how educators deal with the pedagogies that are emancipatory, promote learning equity dialogue, critical pedagogy, learning equity, mediated learning, problem solving as well interactive learning. In addition to the aforementioned pedagogical practices enhancing autonomy in learning, they are key for the promotion of interactive learning and in empowering both educators and their learners (Al-Faki & Khamis, 2014). The democratisation of teaching through smart boards has also been a key though contested feature of technologies in particular when it comes to education. Smart boards, coupled by access to the internet bring the realities of the outside world into the classroom by encouraging educators, in particular those teaching, geography to use online resources (De Silva et al., 2016). Furthermore, self-education may be achieved through implementation of democratic initiatives that can enhance transformation for learners, the school, and society (Au & Apple, 2007). For instance, using smart boards, learners, and educators have been easily accessing a wide range of online useful tools and resources that include knowledge databases and online videos. Besides the online tools complimenting the usual teaching and learning material together with interaction, use of smart boards has been found to lead to improved conceptual understanding across the curriculum.

In extending the argument of democratisation of learning, Mithra (2014) stresses that, the classroom discourse is democratic in so far as it is constructed mutually by students and the teacher. Mutuality can assist in ensuring that learners have equal rights in the classroom conversations and dialogues as well as the right to negotiate the broader curriculum. This approach can be said to resonate with a constructivist approach since learners are given an opportunity to co-develop and evaluate the curriculum. This is crucial as learners need to develop a sense of ownership of their own education. Research proved that course material used in dialogue has been easily communicated using ICT. According to Mithra (2014) learners' thoughts need to be considered quite a lot in terms of course material. In addition, language as part of course material should be situated through consideration of material understanding and relating the materials to their own conditions. Thus, the course material is situated in students' thoughts and language, beginning from their words and understandings of the material, to relating the learning material to their real-life conditions. Relating issues which is also envisaged under the constructivist approach is very important under a democratised dialogical teaching and learning environment.

The issue of smart boards presenting educators with a democratic space in subjects such as geometry and mathematics can be equated to the view by Mithra (2014) who stresses that the classroom discourse is democratic in so far as it is constructed mutually by learners and the teacher. Learners have equal speaking rights in the dialogue as well as the right to negotiate the curriculum (Giroux, 2010). Giroux (2010) also emphasises that critical pedagogy is concerned with offering new ways of thinking critically and acting with authority as independent political agents in the classroom and in larger society to students. In essence, critical

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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pedagogy is concerned with providing students with the skills and knowledge necessary for them to develop their capacities.

It can also be added that through critical pedagogies, there is equally an opportunity to ask the learners to co-develop and evaluate the curriculum. Such an approach also assists learners to develop ownership of their own education through dialogue. This can be achieved using problem posing and solving pedagogies organized and used in the society in conjunction with language. This also implies that educators need to have some sense of appreciation on how learners develop and solve problems through ICTs in particular smart boards. This is crucial to enable the educators to develop appropriate plans and interventions towards the attainment of the desired goals. Appropriate lesson plans characterised by the manipulation of smart boards can also simplify learning and promote conversations and dialogues that can subsequently lead to the sustaining of democratic teaching and learning principles. Thus, conversations promote a social and mutual understanding between educators and learners (Magano et al., 2010). Conversations with the aid of smart boards therefore involve a special way of interactive learning which can promote productivity.

2.8. Challenges Faced in the Use of Smart Boards in Schools

It needs to be understood that although technologies such as smart boards have brought positive transformation in teaching and learning, various challenges have been experienced and documented around the world in terms of integrating the technology to classrooms. Adegbenro and Olugbara (2019) reveal that a number of studies have shown that despite huge investments in ICT with the aim of improving the educational system there is inadequate empirical research evidence drawing from assessing the procedural and pedagogical content knowledge of educators who are less and those more experienced with ICT usage. This has made it difficult to come to affirmative conclusions regarding the positive contributions of technology in school settings. Adegbenro and Olugbara (2019) have also reported that the lack of ICT related skills and knowledge among both experienced and less experienced educators has been a major barrier to realising ICT related goals for colleges and schools.

Lack of services in South Africa's poor communities such as rural areas and informal settlements has been particularly alarming (Pade-Khene, 2018). The apartheid legacy has been mainly blamed for inequalities in service delivery which has been manifested through high levels of imbalance in access to resources, infrastructure and social services. A challenge that remains within education systems including South Africa is however that despite efforts to reform, teaching practices remain largely unchanged. Contrary to embracing emerging technologies, many educators have reportedly remained hesitant to using the technologies in diversifying teaching practices as they have preferred conventional teaching practices they consider "proven". This is despite the conventional practices in many instances alienating learners and reproducing poor learner results.

Despite all efforts associated with enhancing ICT use in South Africa, there have been challenges in the implementation of ICT policies and practices in schools. For instance, the Department of Basic Education has imposed some restrictions in terms of the software programs that could be used by educators. This has been justified as necessary for ensuring security and long life of computers being used (Pelgrum, 2001). Furthermore, Isaacs (2007) stresses that the South African implementation of ICT in the school has been hampered by challenges such as high cost of internet bandwidth, hardware as well as costs in securing the computers. In addition, the use of outdated network software and insufficient number of smart boards in schools are also notable challenges (Karsenti, Collin, & Harper-Merrett, 2011). Cases of alleged unwillingness to embrace technology by some principals and educators have been added on the list of challenges faced in rolling out technologies in schools. Chetty et al. (2018) have also revealed that two key challenges that characterise the digital divide in low- or middle-income communities such as South Africa include limited and costly infrastructure as well as limited digital literacy. In this regard, South African rural and township schools face many challenges that include, inadequate or a complete lack of basic facilities such as water, electricity and toilets. These challenges also include insufficient educational resources such as textbooks, classroom space resulting in overcrowding, poorly qualified educators, a shortage of mathematics, Science and Technology (MST) teachers as well as challenges with the learners themselves (Barlow-Jones & Van Der Westhuizen, 2018).

In addition to the aforementioned challenges, Abuhmaid (2014) has revealed that despite, the tremendous potential gains presented by technologies such smart boards, and the fundamental role such technologies have

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Volume 5, Issue 2, pp. 27-87.
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Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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played in other sectors such as in the business world, no significant influences have emerged in education. Furthermore, Abuhmaid (2014) has indicated that effective use of white interactive boards may be affected by factors such as little ICT education training, lack of follow ups, lack of support by school principals, poor mentoring, inadequate infrastructure, and lack of maintenance of technologies. The implementation of ICT in different areas where it has been used has also been adversely affected by overcrowding in classrooms, lack of adequate computers in computer laboratories, as well as the lack of expertise among educators Pelgrum (2001). Additionally, school management teams who ought to play a crucial role in sourcing as well as allocating ICT resources have notably been at constant loggerheads with educators in terms of implementing ICT (Isaacs, 2007).

According to Karsenti et al. (2011) part of the many challenges in the implementation of ICT in schools have been linked to some educators either being ignorant or resistant to embrace innovative practices and related pedagogies. Similarly, Pelgrum (2001) also notes that some educators are not learner centered in terms of their teaching approaches as they preferred use of the smart board just as a presentation teaching aid whilst adhering to convention methods of teaching.

In many instances, it has been established that, senior educators find it difficult to move from conventional methods to embrace new ones. According to Kennedy (2008) educators who are nearing retirement age are usually complacent and fear embracing ICT in their teaching. They usually prefer using traditional ways of teaching. Some authors have also indicated that usually lack of confidence is also a challenge when it comes to the use of ICT in particular among senior educators (Damcott, Landato, Marsh, & Rainey, 2000; Slay, Sieborger, & Hodgkinson-Williams, 2007). The challenge of lack of confidence and reluctance to embrace new technologies is compounded by the fact that most schools do not invest adequately in professional training. This reduces motivation and commitment towards exploration of the new technologies. Educators who use or intend to have confidence in using technologies such as smart boards, need to be highly committed to enhancing their training. This ought to involve both formal and informal training with the later involving the educator embarking on self-teaching. In one of the studies conducted. Despite the affordances of smart boards, technology is believed to also puts educators under pressure when it comes to content selection as well as lesson preparation. More time is thus needed in compiling content and delivering it. In some instances, it has been noted that some educators also struggle so much when it comes to the issue of modifying and changing the content material to ensure its alignment with the lesson goals and general effectiveness to teaching and learning (Clyde, 2004).

The issue of lack of ICT skills has been found to be a challenge globally. It has also been revealed that lack of skills as well in adequate follow-ups on how educators use the acquired skills remains a key challenge in their capacity to use technology for effective teaching. It has also been revealed that having ICT skills also does not automatically mean that educators are capable of applying them during teaching (Hall & Higgins, 2005). Lack of computer skills has also been found to discourage educators and leave them dejected. Glover and Miller (2001) have also stressed that in some instances educators are faced by feelings of having insufficient time to develop adequate competencies related to new technologies.

The challenge of skills is not just a global challenge is it is more pronounced in the South African context. According to Barlow-Jones and Van Der Westhuizen (2018) a significant proportion of South African educators face the challenge of being unqualified as they possess a grade 12 certificate though studying towards a higher qualification whilst another proportion is underqualified as they have a degree which is however not a teaching qualification. The number of underqualified or unqualified educators according to South Africa's Department of Basic Education (DBE) stands at 5000 educators. This certainly pauses challenges when it comes to the educators' capacities of managing teaching practices especially in an era where they are also called to be innovative and embrace technologies in teaching.

The other challenges especially in poorer communities have related to affordability, cost, and maintenance requirements. It follows that the cost of acquiring the hardware as well as maintenance especially in developing countries has become a pronounced setback. In addition, technical challenges that relate to new technologies have been identified. Some of the technical challenges identified by Leask and Pachler (2013) include freezing of computers and other forms of malfunctioning which usually becomes disruptive to teaching. Related challenges are linked to the smart boards themselves which include malfunctioning of the drives may lead to challenges in failure to respond to the user commands. Periodic loss of connectivity together with poor signal of the internet has also become frustrating challenges for many educators.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Some authors such as Bingimlas (2009) have stressed that the common challenges related to technology ought to be viewed from a holistic approach. As indicated in Figure 4, the combination of factors needing attention when dealing with the effectiveness and integration of technologies such as smart boards in teaching include; teacher's attitudes towards ICT, prevailing ICT policies, teacher training and competencies and, poor infrastructure. The aforementioned factors can thus hinder the successful implementation and integration of ICT in institutions (Korte & Hüsing, 2006).

It needs to be argued that in many instances technology integration in education institutions in particular has failed because of a failure to appreciate the holistic nature of the factors. According to Wheeler (2000) the resistance to the integration of ICT in many education institutions by many educators has had profound effects on the nature of teaching and learning in those institutions. This has also been shown by poor results produced in such schools.

Despite the smart board technology being advantageous in current teaching and learning, educators usually find it difficult to apply certain pedagogies in particular those that can easily be applied through dialogue. Yakin and Tinmaz (2015) note that, in a South African context it was found that learners spend a significant amount of time in interactive online image-rich environments and are accustomed to this environment. Thus, more of online interactions can impact negatively on interactive learning by reducing the opportunity for educator/learner interaction. It thus follows that the use of smart boards as a media to pass information quickly by educator is assumed to bring about limitations in as far as face-to-face interactions between both educator and learners is concerned. Thus, it can be aligned to the transmission of information without much teacher pupil interaction.

There is a common trend that indicates that competency in using technology seem to be a challenge to both senior and newly trained educators. This is something that shows a serious gap in teacher training especially if the training aims at ensuring that educators can cope with the technological obligations common within the current education context where the use of technologies such as smart boards has become inevitable. Whilst educators who have had training on ICTs have high competencies and can capacitate their colleagues, these are few and many educators find themselves having to take up the initiative of familiarising themselves with the technologies such as smart boards. Equally disturbing is the fact that the educators with low competencies in smart board use also showed to have a low rating on the usage of smart board use in improving learning.

Another crucial challenge with introduction of technologies such as smart boards is that some persons may find it difficult to cope with the demands of the new technology. This can apply to individuals accustomed to for instance using methods such as banking. The banking method can be traced to the ideas of Freire (1974) which entails a teaching and learning approach in which students retain information received from the educator and thrive to store it without making efforts to critically engage with it. With respect to smart board technology, usage has remained limited to writing learner materials something which takes him closer to the conventional chalk board method. It needs to be understood that the South African classrooms are generally characterised by a diverse transmission mode of education. Whilst there has been an effort to embrace technology-based education, many schools still lag behind in this regard. This is particularly the case in rural and most public schools in particular those in townships. Since educator-learner ratio is usually major challenge, educators are forced to rely more on conventional methods such as banking as they grapple with the pressure of covering the curriculum. Figure 4 summaries some of the aforementioned challenges that are faced by educators in exploring ICT pedagogies with the aid of smart boards.

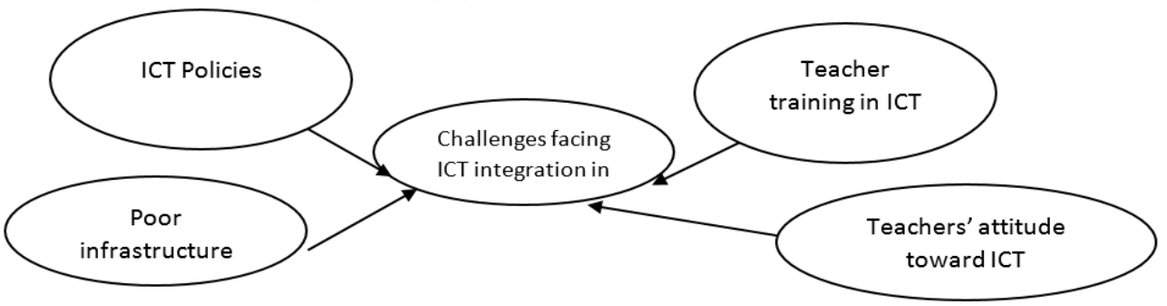


Figure 4. Summary of challenges faced by educators in exploring ICT pedagogies.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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2.9. Theoretical Framework

This study is informed by the social constructivist approach where explanations are linked to the concept of hybrid learning spaces. Constructivism is a theory that equates learning with creating meaning from experience (Bednar, Cunningham, Duffy, & Perry, 1992). This implies that, it is under particular social circumstances that constitute a combination of experiences and practices in this case as it associated with educators that teaching practices and related pedagogies emerge and get shaped.

2.9.1. Social Constructivism

Constructivists believe that knowledge construction is empirical. In this view, Bednar et al. (1992) have alluded that constructivism is a theory that equates learning with creation of meanings from experience and it emerges within contexts in which it is relevant. Constructivists also emphasise that the use of pre-existing knowledge instead of just recalling pre-packaged schemas leads to flexibility (Spiro, Feltovich, Jacobson, & Coulson, 1991). Memory and associated knowledge are developed through recurrence sequences of actions taking place within a context. Issues of constructivism and its influences on understanding educator practices and pedagogies are consequently explored within hybrid learning spaces.

2.9.2. Hybrid Learning Spaces

According to Hilli, Nørgård, and Aaen (2019) a hybrid Learning space involves a context of learning that transcends distinctions between formality/informality analogies or analogue/digital communication/media and other traditionally separable dimensions. In addition, new possibilities for collaboration are potentially offered through exploration of hybrid learning spaces and hybrid pedagogies. Furthermore, Jeong, Hmelo-Silver, and Yu (2014) refer to hybrid learning spaces as computer supported collaborative learning (CSCL). This involves enhancing collaboration through combining physical with digital learning spaces. In this way an educator gets connected to the learners through digital means whilst collaboration takes root. This can also help learners to improve their academic performance as well as lifelong learning (Becker & Luthar, 2002).

The design of learning spaces influences the shaping of learning activities and encourages pursuit of new educational activities (Hilli et al., 2019). Furthermore, digital spaces can support collaborative learning among students and foster a sense of community and shared knowledge (Harasim, 2012). Despite the fact that hybrid learning bridges the gap between online and offline spaces, they also often challenge divisions between educator-learner roles. This is because in reality, with learning being a two way process the educator, learners could swap roles depending on the subject matter at hand.

Within Hybrid Learning spaces, there is a fusion and mixture of contexts, curricula and sometimes media, roles, and countries in new ways. They include online and offline platforms, social media, virtual games, virtual worlds and other kinds of spaces students and teachers learn and teach in. Since smart boards are part of ICT, they can be used to enhance some affordances of hybrid learning spaces. Different pedagogies such as project-based approaches can be explored. Ertmer and Newby (1993) stress that at the core of the constructivist classroom, we often find project-based, problem-based or experience-based learning approaches. Broad skills such as collaboration, creativity, and critical thinking can be explored within a context characterised by hybridity of learning. For instance, collaborative inquiry can assist learners in the development of a sense of community and shared knowledge through the interaction driven by digital technologies in learning spaces (Harasim, 2012). It is from this perspective that the influence of digital technologies can be linked to pedagogies found in teaching and learning. According to Cohen, Nørgård, and Mor (2020) a hybrid pedagogy fundamentally rethinks our conception of place. Furthermore, they emphasise that hybridity is multidimensional since it concerns the interleaving of formal and informal social structures of learning, the combination of physical and digital tools mediating individual's interaction with the world and society, and more. This means that knowledge is acquired through exploration of hybrid learning spaces especially in this information society age. Learning can take place in the form of a project with the educator being a facilitator instead of a knowledge expert. There is thus a relationship between hybridity and how teaching and learning could be understood from a constructivist angle which is a key approach for this study. Furthermore, a major focus of the social constructivism approach in particular where it related to hybridity is that during its development, technology is driven by problem posing and solving whilst at the same time it is socially shaped just like any human made relic is a social construct (Njenga, 2018). The social constructivist

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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approach therefore implies that at any given time, technology reflects the needs and interests of the creators and the meanings contained in their socio-cultural contexts (Njenga, 2018; Van Zyl & Sabiescu, 2016).

It is therefore through a social constructivist lens that the diverse meanings attached to technology together with associated pedagogical practices can be explored. Li et al. (2019) have revealed a considerable amount of research showing that educator's perceived competency related beliefs on technology or self-efficacy in using technology have a bearing on their frequent use of technologies in the classroom. There is an equally critical view that educator's pedagogical beliefs constitute a vital indicator of their use of technology. Importantly to pursue is the question of how the meanings attached to technology relate to pedagogic practices adopted by educators in poorly resourced schools such as those located townships. This approach is further suitable for exploring the strategies adopted by educators in dealing with the day-to-day challenges encountered with regard to using smart boards. Knowledge may therefore not be acquired abstractly within a vacuum as it is dependent on the contextual circumstances.

2.10. Summary

This chapter presented issues surrounding some benefits of smart boards and related educator pedagogies. Furthermore, the chapter presents an overview on the policies and practices that support the use of smart boards in South Africa. The diverse benefits of smart boards in teaching and learning are also presented. Finally, social constructivism is presented as the theoretical framework in particular as it relates to hybridity in teaching and learning spaces. The next chapter discusses the research design.

3. Research Design and Methodology

3.1. Introduction

This chapter discusses the research design and methodology that was adopted in the study. Also, to be discussed is the sampling, profiles of participants, data collection methods as well as the data analysis.

3.2. Research Design

Triangulation was used in the form of 2 methods namely; interviews and observations. The reason why the researcher decided to use two methods was to enhance the capturing of responses and ensure they are as representative as possible of the explanations of the participants. Using the two methods concurrently also allowed for triangulation which aided in the reduction of bias or error that could occur if only one method was adopted to collect the data (Creswell, 2002). A case study was explored during the study.

The researcher collected data using observations (See Table 1) and interviews (See Appendix D). Yin (2015) defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context. This usually takes place within an environment in which boundaries between a phenomenon and the context are not evident. The researcher must explore ways in which participants interact with one another whilst also understanding the unfolding of processes within the confines of the chosen setting. According to Creswell and Creswell (2017) a case study enhances understanding of an event, process, activity or one or more individuals through an in-depth understanding of bound systems.

3.3. Research Methodology

The study was carried out using a qualitative approach. Ngozwana (2018) emphasises that in qualitative research, the aim is to understand the social situation from the participants' perspectives. The approach also enables some degree of flexibility in the research process and a requisite adjustment to be put into effect as the fieldwork unfolds. The qualitative methodology was, therefore, found suitable for this study which explores the state of smart board use and pedagogic practices among educators in township schools. This methodology was further found suitable for assessing the experiences of educators regarding smart board use in township schools together with understanding the pedagogic practices related to smart board use. Above all, the methodology is also suitable for identifying the challenges that educators face when using smart boards.

3.4. Sampling

Purposeful sampling technique was used to choose the four participants for the interviews as well as observations. Ngozwana (2018) emphasises that in purposeful sampling (also referred to as purposive sampling) the researcher selects particular elements from the population that will be representative of the

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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information required about the topic of interest. The researcher targeted educators who have had experiences with smart board as well as those involved in promoting technology usage in the chosen school. Due to the in-depth nature of interviews and observations, four educators who had access to the smart boards were targeted for observations and interviews. Participants included three females and one male. Furthermore, profiles of each participant were compiled.

3.4.1. Profiles of Educator Participants

The data collection focused on three females and one male. This section presents the profiles in terms of the subjects they are teaching at the school of current focus, their qualifications, and brief reflections on their encounters with smart board technology. Importantly, pseudonyms have been used to identify each participant.

D1[1] is a male mathematics teacher. Since 2007, he has been involved in teaching mathematics at different schools prior to joining the current school under study. Subsequent to receiving smart board training in 2014 as part of professional development, in 2015 he embarked on teaching mathematics using the smart boards. This is part of the Gauteng Department of Education ICT policy. As part of professional development, D1 enrolled for a post graduate certificate as well as a Bachelor of education (Honors) in Mathematics degree with University of South Africa. He indicated that initially, prior to 2015 the use of ICT pedagogies was limited.

D2 is one of the female educators who participated in the study. She joined the school under study upon completion of her Bachelor of Education degree for which she majored in Computer Applications Technology. D2 is currently teaching Computer Applications Technology among Grade 10 to 12. She started teaching in 2016 just a year after the Department of Basic Education (DBE) had introduced smart boards. The use of ICT was part of her BEd degree curriculum. Thus, she did not face many challenges in terms of using smart boards. She is also part of the School's ICT committee and she provides assistance with regard to the implementation of ICT policies in line with the DBE policies. Furthermore, she coordinates ICT training particularly for newly trained educators. She is also involved in the distribution of equipment and reporting technical challenges to the district coordinator. She is currently registered for Bachelor of education (Honors) degree in Computer Applications Technology with the University of Pretoria as part of her professional development. She has also been organising some Professional Learning Committees (PLCs) for the school as well as attending District PLC workshops and other workshops as part of professional development.

D3 is another female educator who is a Geography and Tswana teacher. She joined the school in 2000 upon completion of a Diploma in Education. She also did an Advanced Diploma in Education. Just like D1, she started using smart boards in 2015 upon their introduction by the Department of Basic Education. She was also part of educators who attended smart board training in 2014 prior to their introduction to schools in 2015. Thus, as part of the Department of Basic Education ICT policy she uses smart boards to deliver her lessons. She has also been attending some workshops on the use of ICT pedagogies in order to develop professionally.

Lastly, D4 is a Geography and Social Sciences educator at the school under study. Before joining the current school, she taught Afrikaans and Geography at her previous school. She joined the school in 2000 upon completing a university Diploma in Education in 1995. In 2002, she enrolled with North West University for an Advanced Certificate in Education (ACE). She started using the smart board in 2015. It is crucial to note that D4 was among the educators who attended interactive board workshops in 2014. Her knowledge and experience in smart board technology use has been immensely improving. This can be ascribed to her attendance of the Department of Basic Education workshops as well as the PLC workshops at both school and district levels. Ethical considerations were also considered prior to the resumption of the research.

3.5. Data Collection Methods

The researcher used individual interviews (See Appendix D) as well as classroom observations (See Table 1) to collect data. Both interviews and classroom observations were recorded with the interviews recorded as audio whilst observations were recorded using video.

[1] D1 refers to interview participant number. The same way of identification is going to be followed throughout the whole document.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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3.5.1. Interviews

Anthony and Danaher (2016) define an interview as a two-way conversation in which the interviewer asks the participant questions with the aim of collecting data and learning about experiences, ideas, beliefs, views, opinions and behaviours of the participant. In this study, the in-depth interviews focused on exploring the state of smart board use and related pedagogic practices related to ICT use among educators in township schools.

Furthermore, the researcher chose in-depth interviews because they presented an opportunity during educator meetings at which some participants were expressing sentiments about their views on matters that were of interest for the researcher. The researcher conducted individual interviews and took down notes regarding the state of smart board use and related pedagogic practices associated with ICT use among educators. The interviews were also audio recorded.

The interviews seek to address the following research objectives:

- How do educators relate smart board use to pedagogic practices in township schools?
- How do educators deal with challenges faced when using smart boards?

3.5.2. Observations

Observations were used and they targeted educators' engagement in teaching using smart boards. Participants were observed whilst they delivered lessons to understand as well as their experience of smart boards' use especially within the context of pedagogical practices linked to the usage. These were also video recorded to enhance the retention of the details and sequences as highlighted by Anthony and Danaher (2016) who emphasises the need for the researcher to keep more detailed, continuous or sequential accounts of what is observed. Furthermore, Anthony and Danaher (2016) stresses that an observation is a systematic process of recording the behavioural patterns of participants, objects, and occurrences without necessarily questioning or communicating with them. Thus, the observer scientifically studies, analyses, notes or interprets situations.

Observations focus on not only the actions, but also the situation whilst they also try to describe the action in the context in which it occurred. For this study, the intention of the observation was to understand the tacit knowledge patterns in social interactions that may explain educator interpretations surrounding smart board use and related. The observations were easier to carry out also since the researcher is an educator at the school under study. Thus, as a participant observer, first-hand information was easy to collect as is also explained by Creswell (2014) who argues that participant observation is important in research as it gives the fieldworker a vantage point for observing phenomena and collecting first-hand information. The type of information collected through the observation guide is presented in Table 1: Observation schedule.

The observations seek to address the following research objectives:

- What challenges do educators face when using smart boards?
- What are the experiences of educators regarding smart board use in township schools?

Table 1. Observation schedule.

Core focus areas	Outcomes	More Evident	Less evident	Not evident
Problem and solution-based activities	Perform activities that allow learners gain experience that they will later apply in working situations, define problems, develop strategies, collect and interpret data and evaluate opinions	X		
Broadening access	Learners without technologies being able to also use technologies and engage in demonstrations	X		
Educators showing competency in smart board use	Educators displaying different levels of competency in smart board use		X	
Collaborative learning activities/ Working in teams	Working in groups with science simulations and real-life images, videos, learning by doing, discovery learning, exploration, performs real-life meaningful tasks. Allows learners complete control, allows active and interactive learning.	X		
Networking/ forming connections	Collective use of networked simulation systems, connecting to sources of information, visiting websites, accessibility of information, sharing ideas with others through e-mail, chat rooms, etc.	X		
Active collaboration	Collective engagement with tasks, learning in groups, peer interaction, sharing of decision-making.	X		

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
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Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Table 1 shows the observation schedule that was used as a guideline during lesson observations. The table shows how smart board use has been beneficial to learners and some of the challenges faced by educators in particular the issue of competency.

3.6. Fieldwork and Data Collection Processes

The researcher adopted a qualitative case study approach which involved the use of face-to-face interviews as well as lesson observations. An interview guide with a high level of flexibility in the asking of questions was used. The interview guide contained questions that called for deeper explanations on issues and the same questions were asked to the four educators who participated in the study. The educators had to be interviewed during their free time to avoid disrupting lessons. Responses from the educators were recorded and transcribed later, something that saved time for both the researcher and the educators. It is from the transcripts that the coding using ATLAS.ti version 8 then took place as shown in the coding reports in Appendix E.

In terms of observations, the process involved a lesson for each of the four educators who were targeted for key informant in-depth interviews a toolkit that listed aspects targeted for observations was used. The issues included on the observation toolkit are shown in Table 1 included the issue of how smart boards influences access of learners to smart boards, competencies of educators in relation to smart board use as well as how learners experienced the smart board lessons through various activities. The observations were also transcribed and coded using ATLAS.ti version 8. Details on how each instrument was used in data collection are contained in Section 3.2.

3.6.1. Data Analysis

The researcher analysed interview responses from 4 participants and observation field notes from teaching lessons for qualitative content using the coding strategies by Creswell (2014). The researcher was guided by the research questions together with the interview questions. To this end, the researcher engaged in data reduction, coding and decoding analytic processes to analyse and interpret each of these qualitative data forms (Saldaña, 2016). These processes unfolded through concurrent and iterative research processes: data collection, transcription of audio-recorded semi-structured interviews and data analysis. The researcher applied coding terminology and procedures according to Saldaña (2016). The researcher specifically used descriptive codes, which the researcher created inductively (data driven). The researcher created a code list or a code book of 22 codes, created 70 codes across the five data sets, which the researcher reduced to 14 codes, through the merging process. The researcher then clustered codes into four categories, and developed four themes. This was all done in ATLAS.ti version 8, which is a computer assisted qualitative data analysis software package.

This software adds value and sophistication to the coding process, together with an audit trail for transparency of the analysis process (Smit, 2005). Smit (2014) describes ATLAS.ti as is a powerful workbench for the qualitative analysis of large bodies of textual, graphical, audio, and video data. In the course of the qualitative analysis, ATLAS.ti helped me to explore the complex phenomena hidden in the data. All the data, were loaded into the project function, a container for all the data, for subsequent coding. Coding is the procedure of associating code words with sections of data or quotations which is the association between a quotation in the text and a specific code. In linking data, collecting and interpreting the data, coding is the basis for developing the analysis. The researcher clustered codes into four groups, referred to as categories in the literature. In Chapter four the researcher described and discussed (interpret) the research findings based on the categories as the researcher invoke the literature and accompanying relevant theories.

3.6.2. Transcription

In the analysis of qualitative data, the first step is the transcription of the collected data. Explains that transcription is how spoken language is transformed into written text. In this research transcription was verbatim so as to keep the meaning of what participants said as much as was possible Interviews and observational notes were transcribed in order to have written texts so as to understand the educators' views about the use of smart boards in the classroom. The data was transcribed and coded in order to find out some trends that aligned to the following objectives:

- What are the experiences of educators regarding smart board use in township schools?

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
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- How do educators relate smart board use to pedagogic practices in township schools?
- What challenges do educators face when using smart boards?
- How do educators deal with challenges faced when using smart boards?

Interview data was analysed through a thematic analysis which involved framing it into relevant themes and assigning codes and pseudonyms for identifying participants. There were also some symbols that were mostly depicted during interviews. Table 2 shows some of the symbols that were depicted during the interviews and their meanings.

Table 2. Some of the mostly depicted symbols during interviews.

Symbol	Meaning
Eh	Agreeing, certain about what they are saying
Em	Still thinking, not sure
Um	Not sure, still thinking
Neh	Isn't it, you see
Yah	Yes, ok

3.6.3. Coding

Coding was done using a computer program called ATLAS.ti version 8. Creswell (2014) describes coding as a process of organising data by bracketing chunks of texts and writing a word representing a category in the margins. In addition, Kiyimba and O'Reilly (2016) stress that coding is used after having a look at some patterns in terms of the behavioural patterns of the participants and their responses during interviews.

According to Creswell (2014) analysis should be done on a case-by-case basis. For instance, the researcher had to thoroughly go through each of the interview transcriptions in order to come out with units that are meaningful. The researcher had to highlight the codes using different colours. This makes the themes to be more abstract rather than literal. After categorising the codes through identifying some recurring themes that reflects experiences of the participants. The use of codes and categories after transcribing the interviews, helped me in developing a more interpretive approach towards the state of smart board use and pedagogic practices in township contexts.

3.6.4. Themes

What follows below is a list of the main themes and sub themes that emerged from the transcripts. The coding process that led to the production of the main themes and sub themes are presented under Appendix E attached. Four main themes namely; smart board benefits for teaching, smart board benefits for learning, smart board challenges in schools as well as smart board training and the future were developed.

Firstly, sub-themes for main theme 1 include smart board and curriculum benefits, smart board benefits and the importance for teaching, smart board benefits for lesson instruction, smart board integration into teaching different subjects and smart board lesson examples. Secondly, sub-themes for main theme 2 include smart board and interactivity and learner responses smart board benefits for effective academic learning, smart board for productive lesson pace for different learning styles, smart board instruction and conceptual understanding. Thirdly, as for main theme 3, sub themes such as smart board challenges and smart board support for technology use were developed. Lastly, sub themes developed for main theme 4 include smart board interest, smart board training and smart board suggestions for teachers.

3.7. Research Evaluation

3.7.1. Subjective Truth

The participants' views and narratives were accepted as authentic. It was important to ensure that the view of the participant was respected. Despite this room for subjective truth, the researcher still embarked on cross checking some of the information and doing more probing enhance reliability. Upholding some of the ethical aspects such as anonymity also made the participant free to respond the way they deemed fit as indicated by Singh (2015).

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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3.7.2. Validity

Berger (2018) defines a qualitative validity as a way by which findings accuracy check is done. The researcher triangulated the data through examination of the evidence from the interviews as well as observations. This comparison led to the refinement of some of the data to enhance reliability and ensure credibility. As presented by triangulating evidence from different sources was appropriate in this study not because it allowed the researcher to ensure ease of cleaning the data and doing verifications of the collected data.

3.7.3. Credibility

After making sense of the data, analysis is conducted using an inductive or deductive approach for credibility purposes (Bernard, Wutich, & Ryan, 2016). Credibility of research findings also deals with how well the categories cover the data (Lewis, 2015). Since the data is qualitative, I used inductive analysis. I had to do a question-by-question analysis so as to give a clear understanding of the data (Bullock, Little, & Millham, 2017). agree that the analysis process and the results should be described in sufficient detail so that readers have a clear understanding of how the analysis was carried out and its strengths and limitations). This was necessary so as to give the data credibility. As a result, I went through each interview question by question to allow for apprehension of its essential features, without feeling pressured to move forward analytically.

3.7.4. Consistency

The researcher ensured consistency by making certain that questions asked to the respondents were the same and drawn from the key research questions. Equally, a combination of interviews and observations were used for all the participants. In addition, the same school was used as a case since context matters in such studies. This also allowed ease of managing the data as use of different schools despite having an advantage of comparison could have brought unforeseen inconsistencies to the data. In addition, a transcription protocol was followed so that the researcher was consistent throughout the transcription process (Stuckey, 2014).

3.7.5. Neutrality

The researcher had to remain unbiased throughout the study. Being an educator at the same school where the study was carried out posed a threat of having my interests influencing my decisions and handling of the interviews and observations (Tashakkori, Johnson, & Teddlie, 2020). It was important to ensure that these researcher biases are put aside in order to ensure a neutral fieldwork process.

3.7.6. Pilot Study

In order to ensure clarity of the interview questions and observation toolkit, as well as to test the instruments for recording the researcher did a pilot study. This assisted in guaranteeing their transferability (Berger, 2018). This pilot study targeted other educators at the school that were not taking part in the study. These educators were purposively sampled and were given ethical clearance forms as part of ethical considerations. Useful insights received during the pilot were thus used to fine-tune the data collection instruments and other fieldwork strategies. For instance, it was through the pilot that the researcher realized that interviews had to take place in the afternoon when educators where less busy.

3.8. Ethical considerations

Permission to carry out the research was sought from the school principal (See Appendix B). Furthermore, the research sought an ethics clearance from the University of Johannesburg Research Ethics Committee (See Appendix A). With respect to accessing participants from the targeted school, the researcher gained permission through the principal. This was easier as the research was also an educator at the school. In terms of soliciting participation of participants, the researcher explained the nature of the study to all participants as well as what is expected from either party. The participants were also supplied with some consent forms (See Appendix C) as part of ethical procedures prior to the resumption of the research whilst the issue of confidentiality was also emphasised. In addition, the consent forms indicated that participants in the research will remain anonymous and the fact that they are entitled to withdraw their participation from the study whenever they wish to do so. Some factors related to research evaluation that were considered during the

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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study are described below. Faces of learners were also kept out of the video recordings to protect their identities.

3.9. Summary

In this chapter, the research design was presented together with the research site, the data collection methods (interviews and observations), sampling techniques and ethical considerations. The Data analysis procedures were also presented with the coding process identifying main and sub-themes from the raw data. In the next chapter, data presentation and interpretation are discussed following the main and sub themes presented on Section 3.8 with detailed explanation in Appendix E.

4. Research Findings and Discussions

4.1. Experiences and Pedagogic Practices of Township Educators Related to Smart Board Use

4.1.1. Introduction

In the previous chapter, the research design and methodology were described. This chapter discusses the findings of the study. The data was transcribed and coded in order to come out with some trends that aligned to the following objectives:

- What are the experiences of educators regarding smart board use in township schools?
- How do educators relate smart board use to pedagogic practices in township schools?
- What challenges do educators face when using smart boards?
- How do educators deal with challenges faced when using smart boards?

I have created three themes from the qualitative data sets, which I aligned with the study objectives. As mentioned under the participant profiles, pseudonyms are used for each participant, particularly in instances where direct quotes have been used. Responses from the participants are grouped under each broad theme, depending on their relevance. Also, data from observations were used to support in-depth interview data. Each broad theme is directly linked to a particular objective of the study. It follows that the interpretation involves going beyond merely stating raw responses as it goes into a more in-depth analysis.

The coding process which was done with the aid of ATLAS.ti, involved separation, sorting and synthesizing of the data (Saldaña, 2016). Such an approach was important as it required the cleaning of the data for the ease of making comparison among different data sets. Analytic scaffolding involved the researcher carefully scrutinising each response to compare it with the responses from other educators to determine how similar or different they are in particular for grouping purposes. A line-by-line approach to data analysis is also crucial as it enhances analytic thinking while also ensuring that the researcher remains as close to the data as possible, something that promotes the credibility of the analysis and interpretation process (Lautenbach, 2005). Following this process, as mentioned above, which is also explained in Chapter 3, Section 3.6 and detailed in Appendix C led to the main themes under which sub-themes were derived, and key findings presented:

- Theme 1 Smart board benefits for teaching.
- Theme 2 Smart board benefits for learning.
- Theme 3 Smart board challenges in schools.

Each theme has some sub-themes, which will be discussed separately. See: Table 3: Summary of themes and sub-themes below.

Table 3. Summary of themes and sub-themes.

Themes	Sub-themes
Theme 1 Smart board benefits for teaching	Smart board and curriculum benefits Smart board benefits and the importance of teaching Smart board benefits for lesson instruction Smart board integration into teaching different subjects Smart board lesson examples
Theme 2 Smart board benefits for learning	Smart board and interactivity and learner responses Smart board benefits for effective academic learning Smart board for productive lesson pace for different learning styles Smart board instruction and conceptual understanding
Theme 3 Smart board challenges in schools	Smart board challenges: limitations Smart board: support for technology use

International Journal of Educational Studies
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DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
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Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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4.2. Theme 1: Smart Board Benefits for Teaching

Assess the experiences of educators regarding smart board use in township schools

Theme 1 discusses benefits of smart board in teaching. The theme is composed of five sub-themes namely:

a) Smart board and curriculum benefits.
b) Smart board benefits and the importance of teaching.
c) Smart board benefits for lesson instruction.
d) Smart board integration into teaching different subjects.
e) Smart board lesson examples.

4.2.1. Smart Board and Curriculum Benefits

Whilst, smart boards are beneficial across subjects, educators felt that their benefits are more pronounced in subjects such as mathematics. The issue of the multiplicity of activities and concepts that can be explored through smart bards across the diverse subjects in particular when it comes to mathematics can be equated to the multimodal nature of the smart board technology. The ways in which something is represented shapes both what is learnt, that is the curriculum content and how it is to be learnt (Moss et al., 2007). It is in such subjects where a multiplicity of activities and concepts need to be dealt with. (See paragraph 2.4). For educators, it could be challenging to tackle this with the use of printed textbooks, where challenges such as paging are encountered. This is reflected in a response by D12 as follows:

> *I think for all subjects. Yah I think for example in Maths Neh. Its … I think in Maths like you can upload many activities that the learners will be able to do and you can switch from one book to another on the smart board unlike having come with a lot of textbooks and paging through activities is difficult unlike just using the smart board. So like all subjects can fit.* D1 (4000:4376).

Besides mathematics, educators listed Accounting and Science as other subjects where they have derived benefits by using the technologies. The response from D4 captures this is as follows:

> *There are those subjects that are beneficial for smart boards, especially Maths and Eh Accounting and Science all of them they are very, very quick for smart board when we are teaching*". D2 (4850:5026).

For other educators, it is all about one's competency in the curriculum or subject area that influences their use of smart boards. They also indicated the importance of displaying conventional materials such as signs in the case of geography when it comes to smart boards. (See paragraph 2.4). The response from D2 (3628:3658) reflects this relationship between competency in the curriculum or subject and smart board use as follows:

> *Curriculum, I think most content and I can say maybe Geography because I know more about that. There are some diagrams. There some conventional signs whereby learners can see them from the smart board*. D2 (2970:3161).

4.2.2. Smart Board Benefits and their Importance in Teaching

Benefits derived by educators on smart boards are varied. For some educators, smart board technology is a source of multimodality as they can combine pictures with visuals although it is mostly used for writing. The issue of smart boards increasingly being a common feature in today's classroom in South African schools is also revealed by De Silva et al. (2016). (See also paragraph 2.3). The use of smart boards beyond writing is reflected in the response by D2 (4:10 3628:3658) as follows:

> *…Pictures Visuals Mostly writing.*

Educators emphasised that nowadays, technology has become an inevitable and vital part of teaching. They indicated that besides the advantage of internet connectivity associated with smart boards, one could also upload videos and in the process create representations that can aid learning in many ways. This was emphasised by Ilomäki et al. (2016). In addition to this, teaching can also be extended to the home setting as educators can upload materials that learners can access from home and engage with (See paragraph 2.3). D1 (821:1068) response reveals this crucial aspect of the smart board:

> *Nowadays everything is about technology. So I think smart board is very important. You can connect to the internet. You can upload videos, and they can see them while you not there. You can upload worksheets online, and you can also access them at home.*

[2]D1 refers to the first interview (as D1 in the ATLAS.ti programme), and the subsequent numerals refer to the Character counts of the verbatim quotation. This pattern is followed throughout.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Educators also revealed that through a reduction on reliance on paperwork and simplification of the educator's teaching, educators could also assist learners using the smart board. Educators across the different subjects in which they use smart boards further indicated that the smart board allows the educator to load diverse content that includes textbooks and many activities that the learners can use while also being able to switch from one book or activity to another on the smart board. This switch between smart boards and conventional methods is also reflected by Momani et al. (2016) who have argued that a mixture of the conventional methods and digital literacy contributes to academic achievement whilst allowing room for enhancing the positive contributions for adopting such methods in teaching. (See also paragraph 2.3)

Smart board benefits however tend to outweigh those of conventional methods such as the white board and text books. This is contrary to the paging related difficulty that printed books or activities presents or else the laborious nature of writing things on a conventional chalkboard. The emphasis by educators was extended to the smart board being a secure facility to store teaching content. Above all, the smart board was found to reduce teacher workload as the educator can assign a considerable amount of work to learners to deal with under educator aided learning or self-study. Subsequently, using the smart board makes it easier for learners to follow what the educator may be trying to teach them. In this regard, D1 (1136:1255) thus responded:

> *The importance of smart board is for learners to see what you are talking about, and again it reduces the use of papers.*

In another response, educators explained how smart boards assist in lessening the burden on the educator, D2 (1322:1449) responded by saying that:

> *I think as times goes whereby learners can use …what do you call it... not computer...tablets. It reduces teachers' work.*

Educators indicated that the use of smart boards enables learners to make a connection between what they see on the board and real-life issues that they could visualise as they watch images on the board. In this way, the smart board is seen as instrumental in promoting interactivity in lessons as well. Learners have an opportunity to link issues to real life through videos. The significance of visuals that can be displayed during teaching and learning has also been highlighted by scholars such as Njenga (2018); Al-Faki and Khamis (2014). (See paragraph 2.3). The importance of visuals that usually come with smart board use is revealed in a response by D3 (424:536) who put it as follows:

> *It makes teaching very easy and very interactive. You can show learners videos... Videos with a real-life situation.*

Another critical aspect raised by educators in relation to smart boards' benefits and their importance in teaching was that with smart boards, one was able to save their work for future use. This argument can be supported by the view of Momani et al. (2016) who have argued that in addition to having learning materials saved on the smart board and augmenting learner interest, creativity, and imagination is also enhanced. (See paragraph 2.5). This is an important feature as it allows educators to build their material base. Unlike conventional chalkboards, it thus becomes safer to have a platform where information can be stored for future use or for sharing with learners or other educators. This was highlighted in a response by D3 (1259:1423) who had this to say:

> *I said you save your work on a smart board. Tomorrow you find it there, and you can still refer to them nothing is being erased there. You know that your work stays safe.*

Educators also indicated that smart board technology currently assists learners who would otherwise not have received an opportunity to interact with computer-related technologies to do so. This access was reported to form an important component in learning. This is revealed in a response by D4 (978:1291) who put it as follows:

> *I think the importance of smart board is because it's just a new technology that we are using now. Everything even the learner who does not have access to a laptop or computer and learners most of the time when we send them to the smart board they can also get access to use the computer. That is very important.*

4.2.3. Smart Board Benefits for Lesson Instruction

Educators also indicated that they have gained from day-to-day usage of smart boards as it allows flexibility which enables the educators to cover activities that they feel appropriate to learners. The benefits of smart board use and their flexibility during lesson instruction are also explored by Moss et al. (2007). (See

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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paragraph 2.4). Using the smart board has thus proven helpful to both the educators and the learners. D1 (1788:2248) had this to say:

> *That application that you use… Its notes what Eh yes smart tutor Neh. Like you can just do like you know if you want to have an activity with learners… You want them to match a certain concept to a definition. So you can hide the concept, and learners can come and drag the concept and match with a picture or a concept, and you can also do interactive activities. They can also watch some videos, and they can answer the questions from watching a video.*

Educators revealed many ways in which they have benefited from integrating smart board into their regular lesson instruction. Use of smart boards with other modes of instruction was thus seen as an important aspect of every lesson. The importance of smart boards for lesson instruction is further explained by Maher (2012) and Mdlongwa (2012) (See paragraph 2.4). While writing was said to be the dominant mode of smart board use, something that pointed to the technology being underutilised, other methods were also mentioned that include listening, use of visuals as well as combining the printed books with online material. The following response from D1 (4440:4510) reveals this:

> *…listening, visual, and then learners can also come and match concepts.*

To explain the capacity of smart boards to have text books stored for online use, D2 (2213:2276) alluded that:

> *Some of the boards they did install different books for learning.*

D4 (4.5 2755:2954) stressed that:

> *I think the benefits we got. It makes training to be faster in using IT. So, we learn more from the smart board also. Most of the time when we…there is a connection from the laptop to the smart board.*

Smart boards were also found essential for educators as they could download books and question papers from the smart board. In the process, learners can also download requisite materials into their tablets. The benefits of downloading online teaching materials through smarts boards are explained by Mdlongwa (2012). (See paragraphs 2.6). This is revealed in a response by D4 (5317:5533) who revealed that:

> *From the beginning, there are also books from the smart board that you download. You can also download some question papers and solutions, and sometimes they used to be connected from their tablets, especially Grade 12.*

4.2.4. Smart Board Integration into Teaching Different Subjects

In explaining the reason for choosing to use smart boards, educators, indicated that the features of the smart boards have made the boards more favourable compared to other gadgets such as the laptops and tablets. This is also revealed by the Department of Basic Education (2004) who have emphasised that e-Education is more than developing computer literacy and the skills necessary to operate various types of information and communication technologies. (See paragraph 2.2). They emphasized an integrated way of teaching as one can also combine smart boards with other technologies. One educator indicated how they could do work on both the laptops and smart boards. D1 (1452:1654) revealed this in the following response:

> *Because teaching CAT like I said it's about this interactive smart board, using tablets and technology basically for teaching so in everything I do if I am not using my laptop I am using the smart board.*

Educators indicated that the use of smart boards enables learners to make a connection between what they see on the board and real-life issues that they could visualise as they watch images on the board. This view can be supported by the argument by Njenga (2018) who has revealed that since visuals and videos together with other related features of smart boards promote interaction and arouse learner interest, such a state can be linked to the social constructivist approach, particularly its emphasis on problem solving. (See paragraph 2.3). The issue of the boards as sources of quick information for remembering and reflecting on issues was emphasised. This is revealed in a response by D2 (1736:2066) who put it as follows:

> *It's very interesting, and there is that saying "tell me I forget, show me I will remember "So if for example, a teacher is busy teaching primary economic activities Eh, for example, the use of a tractor and when the learner see that from the smart board then they will be able to differentiate between primary and secondary activities.*

The subject of skills and competency held by an educator was found to be important in determining the level of benefits that an educator can derive from using smart board technology. This is reflected by D2 (3247:3569) in the following response:

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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I do not think they are using it all of them like there are some educators that are not in the know-how of using smart board like myself. Maybe there many teachers out there that are still using the smart board for writing purposes only. They cannot take the lesson plans out of the smart board or training should be done.

For some educators, after having received training, it became easier to integrate smart boards into their teaching. This is also highlighted by De Silva et al. (2016) who have emphasised how smart boards have become part of the educator's day to day teaching practices. (See paragraph 2.3). Educators also revealed that they integrated smart boards into their teaching as the technology is safe. The material can also be downloaded and saved to be used on the smart board. D3 (991:1126) revealed this as follows:

My work is always safe in the memory stick. I normally download some staff on a memory stick and use it on a smart board. No more paperwork.

Educators also indicated that it is always important to use books together with the smart board, especially in instances when technology would have failed. This thus points to the complementary nature of the smart board and the book. This complementary nature is reflected in one of the responses by D4 (3024:3470), who said the following:

I can also say yes but because teaching most of the time we use the books. Sometimes I can open the book and explain to my learners, and I can see there is a delay when I press the button to download a book there to check from page to page from smart board. But because using the hard copy is very fast than the smart board because there is also a problem of freezing you see sometimes it is getting freeze and you have to wait and you can continue.

For some educators, smart board technology can be beneficial for all subjects depending on one's competencies and preferences. Some educators, however, indicated that with some subjects such as languages, one mainly uses the smart board just for writing. (See paragraph 2.4). D4 (5118:5237) reflects this as follows:

Yes, but in languages just to write. We just write on the board. Like those, I mentioned before the smart board is very very key.

4.2.5. Smart Board Lesson Examples

For some educators, in particular, those who teach ICT smart boards bring different groups of learners together to the extent that a community where everyone has a free chance of participation is created. Illustrations and feedback were thus found to be crucial in both theoretical and practical aspects of the subjects. The various dimensions in which the smart board has become a key driver in a lesson is presented by D1 (3284:3909) in the response below:

Like Microsoft applications such as Microsoft Excel or PowerPoint. It's much easier when you do it step by step while the learners are also doing it from their PCs. So, a smart board is basically like a computer but a bigger one in the classroom. You can click there, and the learners can do whatever that you are doing. So, a smart board is very important when you are doing practical lessons. And this other time I was… Instead of like explaining the whole lesson, I just make the learners watch a video and then before watching the video; they just did an activity on their own. At the end of the day, they report on the whole lesson.

Geography is included in subjects where smart boards promote flexibility and can serve diverse purposes. Elements of flexibility in learning are posed by constructivists who have emphasised that the use of pre-existing knowledge instead of just recalling pre-packaged schemas leads to flexibility (Spiro et al., 1991). The flexibility can also be interpreted through the views of Hilli et al. (2019) who though their concept of hybrid learning spaces have indicated that a hybrid learning space involves a context of learning that transcends distinctions between formality/informality analogies or analogue/digital communication/media and other traditionally separable dimensions (See paragraphs 2.5.1 and 2.5.2). D3 (1505:1759) also agreed that map work could be easily taught with the aid of smart boards by stating that:

I teach Geography. I have been doing Map work with them. I have been doing synoptic weather maps. You can enlarge some pictures. You can do whatever you want with pictures. You can still write on the same material using smart pen. Yah it's very easy to work with.

For other educators who for instance, teach mathematics using smart boards, the technology makes lessons interesting. (See page 30) They highlighted how different concepts such as Algebra, Trigonometry and

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Geometry have become more interesting through the use of the smart boards. D4 (4490:4752) had this to say on the issue:

> *Most of the lessons as a maths teacher they are very interesting like when I teach Algebra, Trigonometry and Geometry. Also, because while studying about Geometry there are some options when we touch there on the smart board and learners can see what we are saying.*

Four educators were also observed whilst they were delivering some lessons. This was done in order to identify different ways in which educators explore smart board affordances such as multimodality, collaboration and interactivity.

During the first lesson observation, collaboration by exploring affordances of smart boards such as the use of online searches and the use of project-based approaches were not witnessed much during the lesson. Teamwork enhancement was witnessed as learners were discussing the map work concepts during the second lesson observation. The third lesson was presented by D5 (3911:4376. Each learner was sitting behind a PC. The educator demonstrated and gave instructions using the smart board. Learners concurrently practiced the word application skills such as how to edit and separate headings from the contents page on their PCs. Towards the end of the lesson, learners saved their work. Upon ending of the lesson, the educator saved the revision on the smart board. Visuals were used to illustrate some of the desired map work skills. During the fourth lesson, D5 (5431:6044) used the smart tutor application mostly for writing purposes. In addition, learners were allowed to discuss some of the desired concepts through interacting with the smart board. However, in terms of smart board multimodality not much was observed since the educator did not use most of the applications such as visuals, highlighting, shading and so on. Again, although the educator was the one who did most of the talking, the lesson was generally interactive as the educator and learners exchanged information.

4.3. Theme 2: Smart Board Benefits for Learning

Understand how educators relate smart board use to pedagogic practices in township schools.

Under theme 2 different smart board benefits for learning are going to be discussed. The theme is composed of different sub-themes. See: Table on page 51.

4.3.1. Smart Board and Interactivity and Learner Responses

Educators highlighted how engagements between educators and learners can be enhanced through smart boards. The issues of educator learner engagements can also be understood through the views of Jeong et al. (2014) who have referred to hybrid learning spaces as computer supported collaborative learning (CSCL) which involves enhancing collaboration through combining physical with digital learning spaces (See paragraph 2.5.2). In some way, it assists independent learning as the educator does not have to be present all the time as learners do tasks. This is reflected by D1 (4584:4778) in a response that follows:

> *Yes, it does because most of the time it's all about engaging the learners. You don't have to be… The teacher doesn't have to be in control all the time. The learners can also do most of the work.*

Upon being asked to explain how learners have reacted to learning through a smart board, educators highlighted that, learners have mostly expressed keenness in smart board use. They felt that learners also have a degree of respect for the smart board as it is something they are not used to. The conservative approach by learners was however said to be combined with fun. This is reflected by D1 (4880:5301) in the following response:

> *They react very well and actually like the disciplined and behaved when you actually use smart board because it is not something they are used to. So they become interested to know what is happening and the lesson also becomes funnier to them because like when you are writing on the chalk board they might be talking and not concentrating on what you are saying so the smart board can keep them engaged most of the time.*

Smart boards were also praised for allowing continuity of work beyond the classroom. The benefit of learners having to enjoy studying on their own through smart board learning was supported by D3 (2341:2473) whose response is as follows:

> *They enjoyed it a lot because even if you are not at work you can give them work you on a stick or you save work for next coming day.*

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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4.3.2. Smart Board Benefits in Enhancing Learning

Educators indicated that there are many benefits for smart board in the enhancement of effective academic learning. These benefits include access to a variety of activities which can assist learners to relate to the subject matter better. Educators also presented the insight on how a multiplicity of activities permitted by smart boards can enhance learning. (See paragraph 2.1). This was supported by D1 (5383:5799) who has this say:

> *I think I think it benefits them very well because like with a smart board you can use more activities that can be to the advantage of the learner unlike using an explanation just in the textbook. They can be able to relate like seeing a picture and be able to understand what you are talking about unlike just a lot of information. Yes, so on a smart board you can make fun for learners to be able to understand.*

Educators also agreed that the smart board play a crucial role towards the effectiveness of academic learning by accessing application that can assist to do online marking. This can make assessment of learners to be easy. (See page15). In another response D2 (4137:4349) stated the following:

> *In the long run with the use of their tablets and the teacher using the smart board and marking can be done through the smart board Eh connected with their laptops can reduce more work on the part of the teacher.*

With the use of smart boards in learning, learners can have a chance of viewing things from a reality point of view. Since interactivity is one of the essential features of smart boards in particular when it comes to educators drawing from them as educator pedagogies, Mikre (2011) has also emphasised the benefits of projecting visuals on screens as an aid to unpacking complex concepts. (See paragraph 2.3). D3 (2562:2717) also emphasised the importance of interactive learning with the aid of smart boards in exploring ICT pedagogies by saying that:

> *Its interactive learning, they get to see like in the past they used to see volcanoes in the textbook. So kids can see the real deal unlike seeing it on paper.*

Also emphasised by educators was the issue of smart benefits such as access to internet and access to WI-FI. There is enhanced learning through the connection between the smart board to Wi-Fi. In another response D4 (5813:6476) has the following to say:

> *The benefits is just about the new knew technology where they can learn many things. What they can apply to the computer while in class. They can benefit from what you are telling especially in Mathematics. Yah learners are connected to the internet and they can also sometimes go to the lab. There are other teachers teaching IT to help and they come to class to apply it also through the smart board. Yes, the smart board is connected to Wi-Fi because when you check here we have those icons from the computer if you want to go to Google you can from the smart board or you can send emails. Also it's a computer because there is a memory just like the computer.*

4.3.3. Smart Board Benefits for Enhancing Lesson Productivity

Educators also indicated that their day to day use of the smart board technology has increased productivity as the technology ensures that a high amount of material is uploaded onto it through pre-lesson planning. This issue of productivity being enhanced through smart board use is reflected under paragraph 2.3. This allows the educator to strategize and ensure that during the lesson they just display and apply a flexible approach. This therefore becomes important in enhancing lesson productivity. This issue was reported by D1 (2409:2687) as follows:

> *You can save time if you want to display a lot of notes. You can come prepared just like display them on the smart board and just edit there and there unlike having to rubout the whole information from the board and start again so it's easier you just type and getting on with it.*

Smart boards were found to allow a learner centred approach with learners actively participating in the processes. This issue of smart boards providing space for a learner centred process is also emphasised by Maher (2012). (See paragraph 2.4). In addition to this, teaching can also be extended to the home setting as educators can upload materials that learners can access from home and engage with. D1 (2773:3094) response revealed this crucial aspect of the smart board by saying:

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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..... You can use the learner centred approach. When learners… whereby the learner is the one who works there on the smart board. Learners like by themselves interacting with the smart board or you can just upload whatever you want and the learners can do the homework.

For some educators, despite facing competency challenges, the smart board is a useful piece of technology compared to the traditional white board. In addition to writing, they are able to serve their work using memory sticks. D2 (2544:2715) revealed that:

I am not conversant with the use of the smart board I am just using it to write. I am also able to use the USB so that questions are there. So I am just using it for writing.

Some educators indicated that daily use of smart boards in their lessons has been useful as it helped in enhancing their computer skills. Educators also pointed out that one's lesson could be enhanced through regular use of smart board technologies. A response from D3 (1822:1952) revealed that:

All of them especially … all of them. It enhances our computer usage. Yah you gain a lot of things from using the smart board daily.

Other educators felt that if competency can be enhanced through training of all educators on smart boards which could go a long way in enhancing the use of the boards in integrating technology to all learning areas. Emphasis on how South African schools have benefited from training on technology use has been raised by Bialobrzeska and Cohen (2005). (See paragraph 2.2). In that way, smart board technology can thus enhance different learning styles. This is reflected in the response by D3 (2031:2239) who had the following to say:

If they could just Eh train all the all the educators for all learning areas. If all the learning areas are downloaded onto the smart board I think it going to be good for us to integrate it in all learning areas.

Other educators revealed that compared to conventional boards, smart boards present opportunities for learners to be fast and effective. The effectiveness of technology is also raised by Adegbenro and Olugbara (2019) who related it to educator pedagogies. (See paragraph 2.6). In addition to this, the technology allows different methods and processes of teaching and learning to be tried. Such an opportunity presented by smart boards was expressed in a response by D4 (3542:3956) who revealed that:

I can say yes but sometimes it is delaying because the smart board sometimes when you write some things to give to our learners…There is a delay because sometimes you write and wait for the learner to finish before you move to the next page. Then you see the chalkboard before you… you write on one side. Yah sometimes the lesson is going fast. Let's hope with technology next time they will develop a bigger one.

Other educators revealed that use of smart boards creates a democratic space. In this regard, learners are given a broader choice of concepts to select from. In addition, learners are not only able to engage with each other but they are also able to engage with educators in particular since there are more methods and concepts utilised during the teaching and learning processes. D4 (4:8 4040:4388) responded as follows:

We can tell so from learning styles learners can learn in a democratic way Democratic way because the smart board is giving learners that attention that the chalk board because I can also make interest to learners to be in that democratic learning. That democratic learning so that they can be very interesting and focus towards what we are learning.

4.3.4. Smart Board Instruction and Conceptual Understanding

For some educators, the smart board is seen as an interesting piece of technology in particular for learners compared to the traditional white board. D2 (749:1030) thus revealed:

Even though I am not conversant with using smart board but the knowledge that I have I see smart board being an instrument that is more interesting towards learners as compared to the use of may be white board years back. So nowadays there the use of smart board is more interesting.

In another response D4 (579:869) agreed that the use of smart boards makes learning and teaching easier in particular in as far as it presents diverse options that can enhance understanding of concepts. Spiezia (2011) also provides more insight on how smart boards could enhance understanding of concepts in particular when it comes to mathematics. (See paragraph 2.1). Conceptualisation can be promoted through flexibility when it comes to exploring mathematical concepts such as geometry by pointing out that:

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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For the smart board I think when we teach I can give the learners from the smart board to explain about the circle. There are some options I can press and then the circle can appear there and different type of geometry figures so that learners can see. There are many types of pictures there.

Comparing smart boards to the green and white board, in another response D1 (574:707) concurred that smart boards can aid conceptual understanding through the use of videos by saying that:

It assists like very much because you can play videos. It's much more interactive unlike using traditional green board and white board.

4.4. Theme 3: Smart Board Challenges in Schools

Under theme 3 different smart board challenges in schools are going to be discussed. The theme is composed of different sub-themes. See: Table 3: Summary of themes and sub-themes on page 56.

4.4.1. Smart Board Challenges: Limitations

Examine the challenges that educators face when using smart boards.

Despite the celebrated ease of use, educators reported that there are technical challenges with the use of smart board. These challenges include freezing, poor internet connectivity frustrating the downloading process. Leask and Pachler (2013) have also added that some of the technical challenges associated with smart board technology include freezing of computers and other forms of malfunctioning which usually brings disruptions to teaching. (See paragraph 2.4). The freezing and poor internet connectivity usually means in adequate teaching materials. It is therefore important to mention that, in addition to the concern regarding the inadequacy of uploaded materials, educators also expressed worries on the challenge of learners or other educators having access to ones' work and erasing it. In this regard, D4 (6590:6862) had the following to say:

Most of the challenges is freezing. Eh like most of the time before the bell rings the smart board can freeze and it's a technical problem. Most of the time we used to press it off and we can restart again. You can see what you wrote and then you can still stay on the work.

In addition to the smart board technology freezing, educators also added that in some instances smart boards might fail something that could result in people's work being wiped off. This included the challenge of learner tempering with the security system of smart boards. This is reflected on the response as follows:

Sometimes there are because may be the smart board is not working properly or you may have uploaded your work and is deleted. Sometimes the learners are able to access the password and can temper with the smart board. So those are challenges that we experience but in general it's normal

In addition to these aforementioned challenges is the issue of load shedding and poor infrastructure which is common especially in township schools as was stated by D4 (7608:7856) who alluded that load shedding sometimes disrupts learning and teaching in particular where smart boards are used by saying the following:

…no electricity. Like when you are teaching the power goes off. You get stuck because there is no option to go back to the use of chalk board. So, what we do during that time is to give them some work to write and they write it until the power is back.

4.4.2. Smart Board: Support for Technology Use

Explore the strategies that educators use to deal with challenges faced when using smart boards.

Whilst educators who have had training on ICTs have high competencies and can capacitate their colleagues, such instances are few and many educators find themselves having to take up the initiative of familiarising themselves with the technologies such as smart boards. The challenges, in particular that related to senior educators preferring older methods that can be equated to banking are also expressed by Kennewell, Tanner, Jones, and Beauchamp (2008). (See paragraph 4.3.2). It is usually senior educators who face challenges of embracing technology hence they usually find assistance from the younger generation who have a higher competency. D1 (7453:7724) said that ICT committees play a crucial role in training of educators by saying the following:

… because there is an ICT committee that I am part of and sometimes we offer like help to assist the educators but the problem is that their old educators who do not want to attend because they feel inferior like towards the use of smart boards. So support is there.

There were suggestions by educators that in addition to external training workshops periodically provided by the GDE, it is equally possible for schools to draw from the expertise by educators who would have

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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received training. (See paragraph 2.2). It can thus be argued that, in terms of up skilling, educators also receive in-service training which is provided by the Department of Basic Education, ICT committee as well as CAT educators. D2 (5423:5544) who was asked if there was enough support for the use of smart board technology at the school, emphasised the issue of drawing from internal expertise when she uttered the following words:

> *…. because there is a teacher who is in the know-how and is prepared to help and is willing to train and help others"*

It is also important for educators to commit themselves towards the issue of ICT pedagogies training. D3(3301:3573) revealed that it is important to being self-motivated when being trained on how to use ICT pedagogies by having the following to say.

> *Yes, it depends with individual teacher. If you are ready to go for training. That training was conducted the whole of first and second term. It's up to individual teachers to attend if they are really interested.*

4.5. Summary

In this chapter the findings from the interviews and observations were presented under different themes drawn from the qualitative data sets but aligned with the study objectives. The findings are also interpreted with some cross referencing to literature being done. Also presented in this chapter are the participant profiles. Pseudonyms were used in reference to each participant. In the next chapter and overview of the study in the form of conclusions, recommendations for further studies, limitations of the study as well as the final word are presented.

5. Conclusions and Recommendations of the Study

5.1. Introduction

This chapter presents the overview of the study. The chapter encapsulates the main aim of the study which was to explore the state of smart board use and related pedagogical practices within a township context. It is also composed of conclusions that are grounded on findings of the three themes; smart board benefits for teaching, smart board benefits for learning and smart board challenges in schools as well as recommendations. The four educators that were interviewed agreed that the effective use of smart board related pedagogical practices depends on how educators explore a variety of ICT pedagogies as well as address challenges which they face pertaining to use of smart boards. According to Leask and Pachler (2013) some of the technical challenges associated with smart board technology include freezing of computers and other forms of malfunctioning, poor internet connectivity which usually means inadequacy of teaching materials. Furthermore, challenges such as learners or other educators having access to ones' work and erasing it were also experienced. According to De Silva et al. (2016). There are many benefits for enhancement of teaching with the aid of smart boards. Some of the benefits that were mentioned by the educators includes exploration of smart board multimodality, use of visuals saving of work and many others. The three perspectives addressed in the preceding chapter guided the discussion of the research question which was articulated as: *What is the state of smart board use and pedagogic practices in township contexts?*

5.2. Conclusion

The findings under theme 1 focused on smart board benefits for teaching. The study revealed that smart board use like any form of change has benefited educators differently. Ilomäki et al. (2016) elaborates the use of smart boards exposes educators to a multiple of ICT pedagogies that enhances teaching and learning. In many instances smart boards were found more useful in comparison to the green or black boards. It must consequently be noted that unlike the traditional green and white boards, smart boards were found to enhance the curriculum, lesson instruction, and could be integrated into teaching different subjects. This view can be explained through the argument by Spiezia (2011) who has indicated that ICTs play critical roles in teaching and learning which consequently enhance learner achievement. In essence, not only has teaching and learning been made easier through introduction of smart boards but they have also benefited learners to engage with a multiplicity of materials both under the supervision of the educator or on their own. In addition, Adegbenro and Olugbara (2019) stress that access to diverse materials through the smart board allow educators to access

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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multiple tasks that can be provided to learners. In addition, assessments can also be conducted instantly thus saving the educator time.

Under theme 2 which focused on smart board benefits for learning, smart boards were found to be crucial for enhancing speed and quality of teaching. The issues of interactivity and learner responses could be dealt with through smart board. This was found to result in the embracing of different learning styles resulting in effective academic learning. This was found to occur through the smart boards enhancing lesson pace, conceptual understanding as well as productivity in general. According to Njenga (2018) the use of the smart boards therefore further presents educators with some degree of flexibility as the educators have an opportunity to make requisite lesson adjustments with lesser effort and without wasting a lot of time. In addition to learner motivation, a combination of conventional and digital technologies has been found to enhance student interaction whist also having a positive motivational effect on learners (Chetty et al., 2018).

The research further established different usages for the smart board among educators such as writing, material downloads and uploading as well as saving, tasks. Momani et al. (2016) argue that at the centre of the use of the smart board is the issue of the technology's capacity to enhance explanations and discussions during the lessons. The smart board was also found to be important because it allows integrating interactive learning with use of visuals and listening through videos. Above all, the aforementioned capabilities associated with smart boards relates to the possibility of drawing from real life examples especially using visuals and video images.

Smart boards were also found to come handy in providing learners with an opportunity to experience the computer like platform especially for those without access to the gadgets. It was therefore found that smart boards enable learners to share ideas especially with the aim of enhancing innovation (Al-Faki & Khamis, 2014).

Smart boards also proved to be sources of transformative and critical pedagogical practices that are set to enhance the effectiveness of teaching and learning in schools especially the township schools. In this regard, the study established that smart boards are critical in enhancing pedagogic practices (Churcher et al., 2014).

It was noted that with smart boards driving interactive learning, such a learner centred approach not only attracts learners and make it interesting but presents an opportunity for the active participation of the learners, but it was found to empower the learners to take charge of their learning. In essence, smart board technology can enhance inclusivity in teaching and learning (Diemer et al., 2015). In this regard, both educators and learners with no access to computers or other gadgets can get the opportunity to engage with technology driven learning.

Theme 3 focused on smart board challenges in schools. Many challenges were also noted with use of the smart board. Pade-Khene (2018) has explained some of the challenges faced in efforts to ensure educators are skilled in smart board use. One of the commonly identified challenges was the little experience with most of the educators only having a maximum of three years of using the technology. Whilst this is mainly due to the fact that smart boards were only introduced in schools in 2015, this merely shows that government policy meant to promote technological use in schools may be inadequate. It therefore becomes clear that with the identified inadequacies associated with smart board use, their success may be compromised. The competency gap between younger educators finding it easier to embrace new technologies and senior educators who are resistant to new technologies came out as a key finding. The competency gap therefore remains something needing urgent attention. It needs to be however emphasised that despite such notable mixed reactions to smart boards, their use in schools has become inevitable.

The findings of the study also indicate that whilst efforts to train educators exist both within schools and from the Department of Basic Education side, there is reluctance by some educators to take up the initiatives as they still prefer conventional means of teaching. According to Diemer et al. (2015) some educators get stuck to their conventional methods which they view as tried and tested. It is also worrisome that the educators with low competencies in smart board use and needing the training most seem to be the ones resistant to embracing the technology. This group also has a very low approval of technology use and its capacity to improving teaching and learning. It is therefore not surprising that the study revealed widespread underutilization of smart boards and the associated applications as a significant proportion of the educators either faced competency challenges or else still preferred using the smart board for limited tasks such as for writing purposes. In addition to the aforementioned challenges associated with smart board use, educators reported technical challenges that include freezing, poor internet connectivity and load shedding. The risk of

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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learners or other educators erasing or tampering with another person's content was also found to be one of the challenges that could frustrate the teaching and learning process encored on smart boards.

5.3. Recommendations for Various Stakeholders and Further Research

In line with the findings and the preceding discussion, it is recommended that government should ensure that it follows a holistic approach in dealing with introduction of new technologies such as smart boards. This is largely because since technology is a social construct and therefore deeply embedded into people's lives, the way that persons, in this case educators interpret the new technology can have positive or negative implications on its introduction. In this regard, Adegbenro and Olugbara (2019) stress that educators should be encouraged to use smart boards especially as they have proven to be conducive for enhancing interactive learning. In addition to targeting educators in efforts to ensure that the resistance to the technology is minimized or eliminated, an integrated approach involving use of smart boards and conventional methods whilst targeting learners for their capacitation to draw as much as they can from interacting with the smart board could be used. Giving learners an opportunity to interact with the smart board applications such as the smart tutor can enhance their capacity to be responsible citizens.

The Gauteng Department of Education officials, School Management Teams (SMT), educators as well as learners as important stakeholders need to be trained in order to ensure that they remain positive when it comes to teaching and learning through smart boards. In South Africa SMTs are the leaders within a school system whose sole function is giving leadership guidance, direction and assistance in the teaching/learning situation. It is further recommended that follow ups be done to check on the implementation of ICT policy in education (Ayemoba, 2013). Otherwise, those that are resistant or hesitant to implement ICTs might continue avoiding the new technologies at the expense of the learners. Above all these recommended measures, white boards should still be made available for use by educators especially considering the challenges of load shedding and technical challenges associated with schools in the township settings.

In terms of further research, the researcher recommends that more research on influence of smart boards towards improving the standard of learning and teaching be carried out. This should be carried out in order to come out with new ways of ensuring that schools in poor areas such as townships can fully derive maximum benefits from smart boards particularly in relation to improving performance in as far as smart board use is concerned. According to Al-Faki and Khamis (2014) learning environment can be further democratized and made more conducive in line with the concepts of situated and mediated learning with the broader aim of empowering the learners through a learner centered approach.

5.4. Limitations of the Study

The research was limited to only four high school educators from one school. Despite the fact that data collection was easy, perhaps more representative results could have been achieved had more schools and a wider population of educators been included. Classroom access coupled with time constraints were also a limitation since more research activities had to be done after school when concentration among both educators and learners would have gone down.

5.5. Summary of the Study

This section provides a summary of the study for each chapter. These are summaries for Chapters 1-4.

This Chapter 1 presented a brief introduction which outlines the key focus of the study, background which deals with an overview of empirical evidence from previous studies and how it relates to the current study, an overview of the research context which explores the scope of the study; significant of the research which deals with the knowledge gap filling aspect and policy importance brought by the research. Chapter one has also presented questions and objectives, as well as the rationale and the problem being pursued by the study. The next chapter presents the literature review and the theoretical framework.

Chapter 2 presented issues surrounding some benefits of smart boards and related educator pedagogies. Furthermore, the chapter presents an overview on the policies and practices that support the use of smart boards in South Africa. The diverse benefits of smart boards in teaching and learning are also presented. Finally, social constructivism is presented as the theoretical framework in particular as it relates to hybridity in teaching and learning spaces. The next chapter discusses the research design.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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In Chapter 3, the research design was presented together with the research site, the data collection methods (interviews and observations), sampling techniques and ethical considerations. The Data analysis procedures were also presented with the coding process identifying main and sub-themes from the raw data. In the next chapter, data presentation and interpretation are discussed following the main and sub themes presented on Section 3.8 with detailed explanation in Appendix E.

In Chapter 4 the findings from the interviews and observations were presented under different themes drawn from the qualitative data sets but aligned with the study objectives. The findings are also interpreted with some cross referencing to literature being done. Also presented in this chapter are the participant profiles. Pseudonyms were used in reference to each participant. In the next chapter and overview of the study in the form of conclusions, recommendations for further studies, limitations of the study as well as the final word are presented.

Chapter 5 presents conclusion and recommendations for various stakeholders and further research. The chapter also consists of the final word.

5.6. A Final Word

The inevitability of smart board use as a form of technology means that schools need to be better capacitated to successfully embrace their use. This needs a holistic approach that needs to target enhancing the competencies of all educators through periodic workshops as well as dealing with technical challenges associated with smart board use such as freezing and security breaches. Above all, the study has shown that well intended interventions may fail if holistic processes are not adopted. Above all, township schools in South Africa, just like other poor settings affected by the apartheid legacy have challenges that are peculiar such that any attempts to address them ought to take the contextual issues seriously. Finally, it must be argued that smart board technologies, despite the challenges they have faced, still represent an important step in the transformation of education in poor areas such as townships.

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International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*

Email: smate100@uottawa.ca

Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022

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International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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APPENDICES

Appendix A: Ethical Clearance

NHREC Registration Number REC-110613-036

UNIVERSITY OF JOHANNESBURG

ETHICS CLEARANCE

Dear Simbarashe Matemera

Ethical Clearance Number: 2018-023

Conceptual knowledge teaching with smart boards: a case of a South African school Township school

Ethical clearance for this study is granted subject to the following conditions:

- If there are major revisions to the research proposal based on recommendations from the Faculty Higher Degrees Committee, a new application for ethical clearance must be submitted.
- If the research question changes significantly so as to alter the nature of the study, it remains the duty of the student to submit a new application.
- It remains the student's responsibility to ensure that all ethical forms and documents related to the research are kept in a safe and secure facility and are available on demand.
- Please quote the reference number above in all future communications and documents.

The Faculty of Education Research Ethics Committee has decided to

☒ Grant ethical clearance for the proposed research.
☐ Provisionally grant ethical clearance for the proposed research
☐ Recommend revision and resubmission of the ethical clearance documents

Sincerely,

Dr David Robinson
Chair: FACULTY OF EDUCATION RESEARCH ETHICS COMMITTEE
11 May 2018

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Appendix B: Consent Letter for the Principal

Dear Sir/Madam

RE: Invitation to participate in a research study

Title of research project	Smart board use and pedagogic practices among educators: a case of a south african township school
School/University	University of Johannesburg

I am a Masters student interested in conducting research to establish how educators perceive the use smart boards and pedagogic practice among educators. This letter therefore serves to request your permission to visit your school and to observe some lessons conducted by some teachers using smart boards. The lesson observations would be followed up with interviews of four teachers within the school.

Aims of the study

The aim of this study is to explore the state of smart board use and related pedagogical practices within a township context. It seeks answers to the following questions:

- What are the perceptions of educators regarding smart board use in township schools?
- How do educators relate smart board use to pedagogic practices in township schools?
- What challenges do educators face when using smart boards?
- How do educators deal with challenges faced when using smart boards?

Brief background to the study

The assumption of the study is that teachers have different perceptions on the affordances of smart boards as well as ICT pedagogies that come along with the embracement of ICT in learning and teaching. The study is aimed at investigating the enhancement of ICT pedagogies and challenges that have come along the implementation of ICT policies in schools.

It is in this light that I wish to observe lessons in the classrooms so as to be able to understand the enhancement of ICT through implementation of a variety of teaching strategies used by teachers. The observations will be followed by face-to-face interviews with the teachers in order for me to fully understand the smart board enhanced interactions and strategies not only from my own interpretations but also from the perspectives of teachers.

What is of interest in the research?

The researcher envisages that the results of this study will go a long way in clarifying aspects of the school curriculum that might be important for understanding the affordances of smart boards in schools.

Participation is voluntary

If you agree to participate in this study, please understand that the participation of your staff is entirely voluntary. They can refuse to answer a particular question or elect to withdraw at any time without any penalty. They are not required to take part in this research as part of their job. Please also note that participants are guaranteed protection from harm and that the principle of utmost confidentiality is also guaranteed in what they say during the course of the interviews with the researcher. It will only be used anonymously for purposes of this research.

Withdrawal from the study/termination of the interview

Some of the circumstances under which participation in the study may be terminated by the researcher without regard to your consent are as follows: Where there is reluctance to provide data that you might find compromising to your interests and where it is the subject/participant's decision to withdraw from the research study/interview process, a form will be readily available to sign as indication of unwillingness to continue participation.

International Journal of Educational Studies
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Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Written consent to participate in the research

I _____ do hereby give consent for our school to participate in this research. I acknowledge that I have been sufficiently furnished with the aims of the study. I therefore on behalf of _____school give my informed consent for the researcher to schedule appointments with the relevant class teachers and pupils.

---------- ----------

Signature of Principal/Head of school Date

---------- ----------

Signature of person obtaining consent Date

Questions

If you have any questions about this study or your rights as a participant, you may contact: Simbarashe Matemera on mobile +27 736366225 email: matemerasa@gmail.com

Professor Geoffrey Lautenbach (Dissertation supervisor)

Faculty of Education**,** Department of Science & Technology Education, Tel +27 11 559 3016, Fax +27 11 559 2292 Email: geoffl@uj.ac.za

Professor Devika Naidoo (Dissertation co-supervisor), Department of Curriculum Studies, Faculty of Education, Auckland Park, Kingsway campus, P.O. Box 524, 2006 Auckland Park, Kingsway campus, Email: devikan@gmail@uj.ac.za

Professor David Robinson: Chair of Ethics Committee, University of Johannesburg, Department of Education studies, Faculty of Education, Auckland Park, Kingsway campus, P.O. Box 524, 2006 Email: davidr@uj.ac.za

Appendix C: Consent letter for participating educators

Dear Sir/Madam

Re: Invitation to participate in a research study

Title of research project	Smart board use and pedagogic practices among educators: a case of a south african township school
School/University	University of Johannesburg

I am a Masters student interested in conducting research to establish how educators perceive the use smart boards and pedagogic practice among educators. This letter therefore serves to request your participation in the study. I wish to observe one lesson in which you use the smart board as learning and teaching aid. The observations would be followed up by interviews in order for me to fully understand your views of how teachers perceive the use of smart boards as well embracing different ICT pedagogies. If you are willing to participate in this study, please understand that you would be observed teaching for an hour once and be interviewed for between 45 minutes and one hour per session at a place most convenient to you.

I would gladly appreciate it if you could respond to my request at your earliest convenience and if necessary, furnish me with more details or guidance on your requirements for the research not to be compromising to you and your school.

Aims of the study

The aim of this study is to explore the state of smart board use and related pedagogical practices within a township context. It seeks answers to the following questions:

- What are the perceptions of educators regarding smart board use in township schools?
- How do educators relate smart board use to pedagogic practices in township schools?
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- How do educators deal with challenges faced when using smart boards?

Brief background to the study

- The assumption of the study is that teachers have different perceptions on the affordances of smart boards as well as ICT pedagogies that come along with the embracement of ICT in learning and teaching. The study is aimed at investigating the enhancement of ICT pedagogies and challenges that have come along the implementation of ICT policies in schools

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
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Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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- It is in this light that I wish to observe lessons in the classrooms so as to be able to understand the enhancement of ICT through implementation of a variety of teaching strategies used by teachers. The observations will be followed by face-to-face interviews with the teachers in order for me to fully understand the smart board enhanced interactions and strategies not only from my own interpretations but also from the perspectives of teachers.

What is of interest in the research?

- The researcher envisages that the results of this study will go a long way in clarifying aspects of the school curriculum that might be important for understanding the affordances of smart boards in schools.

Participation is voluntary

- If you agree to participate in this study, please understand that the participation of your staff is entirely voluntary. They can refuse to answer a particular question or elect to withdraw at any time without any penalty. They are not required to take part in this research as part of their job. Please also note that participants are guaranteed protection from harm and that the principle of utmost confidentiality is also guaranteed in what they say during the course of the interviews with the researcher. It will only be used anonymously for purposes of this research.

Withdrawal from the study/termination of the interview

- Some of the circumstances under which participation in the study may be terminated by the researcher without regard to your consent are as follows: Where there is reluctance to provide data that you might find compromising to your interests and where it is the subject/participant's decision to withdraw from the research study/interview process, a form will be readily available to sign as indication of unwillingness to continue participation.

Written consent to participate in the research

Yes	**No**	**In the event of the following being the case, I will still be willing to participate in the study:**
		Realizing that the answers I provide will not compromise in any other form what I regard as my contribution as a teacher.
		Adversely affect my job in one form or another
Yes	**No**	**I give my informed consent for:**
		This lesson to be observed and or be video/audio taped
		This interview to be video/audio taped
		The tape/transcript to be used for writing this thesis
		Providing guidance as to how the information may be further used or not

I _____ hereby give my informed consent to participate in this research. I acknowledge that I have been sufficiently furnished with the aims of the study.

---------- ……

Signature of Teacher Date

---------- ……

Signature of person obtaining consent Date

Personal contact details of the teacher (This will be kept confidential and will not be used to identify you in the actual study)

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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Name	
Contact address	
School grade/form	
Phone No	Home: Work: Mobile:
Email address	

Questions

If you have any questions about this study or your rights as a participant, you may contact: Simbarashe Matemera on mobile +27 736366225 email: matemerasa@gmail.com

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Appendix D: Interview Questions

Background Information:

1. How many years have you been using the smart board?
2. Is the smart board a large part of your teaching? If yes, how?
3. How did you come to be interested in integrating smart board into your teaching?

Understanding of Topic:

1. In your opinion, what is the importance of smart board? What role does it play in today's teaching?
2. How were you introduced to the interactive whiteboard? Did you receive official training? How did you learn how to use it/integrate it?
3. What made you decide to integrate smart board technology into your daily lesson routines?

Benefits:

1. What are some benefits have you found in integrating smart board technology into your regular lesson instruction?

Strategies:

1. Can you provide some examples of lessons you have done with the assistance of a smart board?
2. Which curriculum area do you feel the smart board is most beneficial for? Why?
3. How can this piece of technology be integrated across all curriculum subjects?
4. Do you use smart boards with other modes of instruction?
5. How does smart board instruction aid conceptual understanding differently?
6. How does smart board instruction aid different learning styles?

Perceived Student Impacts:

1. From what you have observed, how have your students reacted to learning through a smart board?
2. In your opinion, how can a smart board benefit student academic learning?
3. Does the way you use smart board technology enable interactivity? How?
4. Does smart board use enable a productive pace in the lesson?

Challenges:

1. Are there any limitations when using smart board for lesson instruction? If so, what are they?
2. Have you experienced any trouble with interactive smart board? If so, how did you overcome this challenge?
3. If I asked you to name the most challenging thing regarding the integration of smart board into your lesson instruction, what would it be

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Conclusion:

1. Would you suggest that all teachers start to integrate this technology into their regular lesson instruction? If yes, why? If not, why not?
2. In your opinion, is there enough support for the use of this technology in your school?
3. Do you have any final comments or opinions in relation to integrating smart board technology into regular lesson instruction?

Adapted from INTEGRATION OF INTERACTIVE WHITEBOARD TECHNOLOGY IN REGULAR LESSON INSTRUCTION

Appendix E: Interview Transcriptions

Interview transcription- Participant D1

Background

1. How many years have you been using the smart board?

Good afternoon Sir. Eh I can say three years

2. How did you come to be interested in integrating smart board into your teaching?

Em while I was doing my practicals. Neh because I am teaching CAT…Like… Using smart boards and tablets was a big part of my teaching and learning. So I started using the smart board while I was doing my practicals.

Understanding of Topic:

1. How does smart board instruction aid conceptual understanding differently?

Can you repeat the question? It assists like very much because you can play videos. It's much more interactive unlike using traditional green board and white board.

2. In your opinion, what is the importance of smart board? What role does it play in today's teaching?

Em because nowadays everything is about technology. So I think smart board is very important. You can connect the internet. You can upload videos and they can see them whilst you not there. You can upload worksheets online and you can also access them at home

3. How were you introduced to the interactive whiteboard? Did you receive official training? How did you learn how to use it/integrate it?

No I did not receive any training it's my first year of teaching. So I familiarise myself with the smart board whilst I was doing my teaching practicals

4. What made you decide to integrate smart board technology into your daily lesson routines?

Because teach CAT like I said Neh It's about this interactive smart board, using tablets and technology basically for teaching so in everything I do If I am not using my laptop I am using the smart board

Benefits:

1. What are some benefits have you found in integrating smart board technology into your regular lesson instruction?

Em that application that you use… Its notes what Eh yes smart tutor Neh. Like you can just do like you know if you want to have an activity with learners… You want them to match a certain concept to a definition. So you can hide the concept and learners can come and drag the concept and match with a picture or a concept and you can also do activities that are interactive. They can also watch some videos and they can answer the questions from watching a video.

2. Is the smart board a large part of your teaching? If yes, how?
3. Does smart board use enable a productive pace in the lesson?

Eh you know with smart board Neh…You can save time if you want to display a lot of notes. You can come prepared just like display them on the smart board and just edit there and there unlike having to rubout the whole information from the board and start again so it's easier you just type and getting on with it.

Strategies:

1. How does smart board instruction aid different learning styles?

Ah um I think like the smart board was created for every subject. You can use the learner centred approach. When learners… whereby the learner is the one who works there on the smart board. Learners like by

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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themselves interacting with the smart board or you can just upload whatever you want and the learners can do the homework.

2. Can you provide some examples of lessons you have done with the assistance of a smart board?

Yes, it is…. like I said I use in almost everything yeh
Like when I teach practical work Neh. Like Microsoft applications such as Microsoft excel or PowerPoint. It's much easier when you do it step by step while the learners are also doing it from their PCs. So a smart board is basically like a computer but a bigger one in the classroom. You can click there and the learners can do whatever that you are doing. So a smart is very important when you are doing practical lessons. And this other time I was… Instead of like explaining the whole lesson I just make the learners watch a video and then before watching the video they just did an activity on their own. At the end of the day they report on the whole lesson and yah.

3. Which curriculum area do you feel the smart board is most beneficial for? Why?

I think for all subjects. Yah I think for example in Maths Neh. Its … I think in Maths like you can up load a lot of activities that the learners will be able to do and you can switch from one book to another on the smart board unlike having come with a lot of textbooks and paging through activities is difficult unlike just using the smart board. So like all subjects can fit.

4. Do you use smart boards with other modes of instruction?

Eh listening, visual, and then learners can also come and match concepts.

5. Does the way you use smart board technology enable interactivity? How?

Yes, it does because most of the time it's all about engaging the learners. You don't have to be… The teacher doesn't have to be in control all the time. The learners can also do most of the work. Eh

6. From what you have observed, how have your students reacted to learning through a smart board?

They react very well and actually like the disciplined and behaved when you actually use smart board because it is not something they are used to. So they become interested to know what is happening and the lesson also becomes funnier to them because like when you are writing on the chalk board they might be talking and not concentrating on what you are saying so the smart board can keep them engaged most of the time.

7. In your opinion, how can a smart board benefit student academic learning?

Yeh I think I think it benefits them very well because like with a smart board you can use more activities that can be to the advantage of the learner unlike using an explanation just in the textbook. They can be able to relate like seeing a picture Neh and be able to understand what you are talking about unlike just a lot of information. Yes, so on a smart board you can make fun for learners to be able to understand.

Challenges:

1. Are there any limitations when using smart board for lesson instruction? If so, what are they?

Eh... Ah... Sometimes there are because may be the smart board is not working properly or you may have uploaded your work and is deleted. Sometimes the learners are able to access the password and can temper with the smart board. So those are challenges that we experience but in general it's normal.

2. Have you experienced any trouble with interactive smart board? If so, how did you overcome this challenge?

No I haven't been Eh

3. If I asked you to name the most challenging thing regarding the integration of smart board into your lesson instruction, what would it be?

Eh I wouldn't say … The most challenging thing that the learners neh. … Sometimes they don't know like where to touch and... But as for me the educator … because I am teaching CAT I know computers I do not have any problems. The only problem is when be if we knew how to fix it ourselves… Eh Yes. But in general everything is perfect

Conclusion:

1. Would you suggest that all teachers start to integrate this technology into their regular lesson instruction? If yes, why? If not, why not?

Uh Yes I would because like you can see how technology is developing these days from now you will be able to realise that may be like in ten years' time. … Neh Technology will be advanced so that teachers should be

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
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DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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able to use the smart board starting now because you do not know in the future like the many advances that are going to happen. So I encourage all the teachers to use technology.

2. In your opinion, is there enough support for the use of this technology in your school?

Yah there is because there is an ICT committee that I am part of and sometimes we offer like help to assist the educators but the problem is that their old educators who do not want to attend because they feel inferior like towards the use of smart boards. So support is there.

3. Do you have any final comments or opinions in relation to integrating smart board technology into regular lesson instruction?

Yah I think may be if they get away …If they get rid of textbooks everything become ICT, the use of smart board will be more utilised and also because now most educators are still using textbooks instead of smart boards which benefits the learners there must be a policy may be in place that will say no more textbooks, let's focus on ICT and like... It also makes the work so easier. You know paperless means no stress.
Thank you.

Participant D2
Background

Afternoon Fine and you

1. How many years have you been using the smart board?

Ok I think for now its one year

2. How did you come to be interested in integrating smart board into your teaching?

Um Ok hence it is what you call it... Hence the policy Eh says you must Eh use this then and some of the things that are valued here. Eh learners can be able to see them while you are using the smart board because I can see that when you are using the smart board… Because I can see that when learners see something from the smart board they at least… they can be able to remember.

Understanding of Topic:

1. How does smart board instruction aid conceptual understanding differently?

Pardon...Eh even though I am not conversant with using smart board but the knowledge that I have I see smart board being an instrument that is more interesting towards learners as compared to the use of may be white board years back. So nowadays there the use of smart board is more interesting.

2. In your opinion, what is the importance of smart board? What role does it play in today's teaching?

Eh the importance of smart board is for learners to see what you are talking about and again it reduces the use of papers.
Role of smart board in today's teaching
Um for example Grade 12 Eh I think as times goes whereby learners are able to use …what do you call it... not computer...tablets. It reduces teachers work

3. How were you introduced to the interactive whiteboard? Did you receive official training? How did you learn how to use it/integrate it?

Um we did attend training for interactive whiteboards

4. What made you decide to integrate smart board technology into your daily lesson routines?

Ah its very interesting and there is that saying "tell me forget Ehm show me I will remember "So if for example a teacher is busy teaching primary economic activities Eh for example the use of a tractor and when the learner see that from the smart board then they will be able to differentiate between primary and secondary activities.

Benefits:

1. What are some benefits have you found in integrating smart board technology into your regular lesson instruction?

Eh em for example some of the boards they did install different books for learning.

2. Is the smart board a large part of your teaching? If yes, how?

Is the smart bard a large part of your teaching?

3. Does smart board use enable a productive pace in the lesson?

No

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Strategies:

1. How does smart board instruction aid different learning styles?

Eh because I am not conversant with the use of the smart board I am just using it to write. I am not able to use the USB so that questions are there. So I am just using it for writing

2. Can you provide some examples of lessons you have done with the assistance of a smart board?

Oh Oh topic? Even I was just using smart board to write Eh Population Geography

3. Which curriculum area do you feel the smart board is most beneficial for? Why?

Curriculum think most content and I can say may be geo because I know more about that. There are some diagrams. There some conventional signs whereby learners can see them from the smart board.

4. How can this piece of technology be integrated across all curriculum subjects?

Um I do not think they are using it all of them like there are some educators that are not in the know-how of using smart board like myself. May be there many teachers out there that are still using the smart board for writing purposes only. They cannot take the lesson plans out of the smart board or training should be done.

5. Do you use smart boards with other modes of instruction?

Pictures Visuals Mostly writing

Perceived Student Impacts:

1. Does the way you use smart board technology enable interactivity? How?

No not much because I am not in the position take or show different conventional signs in Geography. I still needs more workshops on that

2. From what you have observed, how have your students reacted to learning through a smart board?

I think Yah most of them they are interested in that

3. In your opinion, how can a smart board benefit student academic learning?

Yah because Um in the long run Eh with the use of their tablets and the teacher using the smart board and marking can be done through the smart board Eh connected with their laptops can reduce more work on the part of the teacher.

Challenges:

1. Are there any limitations when using smart board for lesson instruction? If so, what are they?

Yah sometimes they freeze you won't be able to teach or if there is load shedding

2. Have you experienced any trouble with interactive smart board? If so, how did you overcome this challenge?
3. If I asked you to name the most challenging thing regarding the integration of smart board into your lesson instruction, what would it be?

Um up to now so far there are a lot of challenges that I have experienced. I did not manage to solve them hence I need more training. To overcome that I f I cannot use the smart board I can use the white board to write.

Conclusion:

1. Would you suggest that all teachers start to integrate this technology into their regular lesson instruction? If yes, why? If not, why not?

Yes, there should... Um there should... because it is very interesting towards the learners. For example, some of the lessons can be taught using PowerPoint and...

2. In your opinion, is there enough support for the use of this technology in your school?

Yes, there is because there is a teacher who is in the know-how and is prepared to help and is willing to train and help others

3. Do you have any final comments or opinions in relation to integrating smart board technology into regular lesson instruction?

Ok Yah in conclusion my final COMMENTS Um in relation to integrating smart boards into the lesson is that if the SMT can make it compulsory to teachers to use the smart board pass rate might increase.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Participant D3
Afternoon Sir
Background
How many years have you been using the smart board?
Three years now
How did you come to be interested in integrating smart board into your teaching?
Yes, I download some information from the internet and use them in the class with my learners

1. In your opinion, what is the importance of smart board? What role does it play in today's teaching?

It makes teaching very easy and very interactive. You can show learners videos... Videos with real life situation

2. How were you introduced to the interactive whiteboard? Did you receive official training? How did you learn how to use it/integrate it?

After noticing that you can save your files there nothing gets rubbed off

3. What made you decide to integrate smart board technology into your daily lesson routines?

Yes, we were trained by some officials there

4. What made you decide to integrate smart board technology into your daily lesson routines?

After Eh Then My work is always safe in the memory stick. I normally download some staff on memory stick and use it on smart board. No more paper work

Benefits:

1. What are some benefits have you found in integrating smart board technology into your regular lesson instruction?

Like I said you save your work on smart board. Tomorrow you find it there and you can still refer to them nothing is being erased there. You know that your work stays safe

2. Is the smart board a large part of your teaching? If yes, how?

Normally I do. I teach Geography. I have been doing Map work with them I have been synoptic weather maps. You can enlarge some pictures. You can do whatever you want with pictures. You can still write on the same material using smart pen. Yah it's very easy to work with

3. Does smart board use enable a productive pace in the lesson?

All of them especially … all of them. It enhances our computer usage. Yah you gain a lot of things from using the smart board daily

Strategies:

1. How does smart board instruction aid different learning styles?

If they could just Eh train all the all the educators for all learning areas. If all the learning areas are downloaded onto the smart board I think it gonna be good for us to integrate it in all learning areas.

Perceived Student Impacts:

1. Does the way you use smart board technology enable interactivity? How?

They enjoyed it a lot because even if you are not at work you can give them work you on a stick or you save work for next coming day.

2. In your opinion, how can a smart board benefit student academic learning?

Like I said its interactive learning they get to see like in the past they used to see volcanoes in the textbook. So kids can see the real deal unlike seeing it on paper

Challenges:

1. Are there any limitations when using smart board for lesson instruction? If so, what are they?

Not I know of. As long as you are computer literate you can be able to manoeuvre the smart board. It needs competence in computer literacy.

Conclusion:

1. Would you suggest that all teachers start to integrate this technology into their regular lesson instruction? If yes, why? If not, why not?

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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The sooner the better because forward we go with technology. Down with paper work.

2. In your opinion, is there enough support for the use of this technology in your school?

Yes, yes. It depends with individual teacher if you are ready to go for training. That training was conducted the whole of first and second term. It's up to individual teachers to attend if they are really interested. Getting ourselves developed through the use of a smart board

3. Do you have any final comments or opinions in relation to integrating smart board technology into regular lesson instruction?

I love it. I love the use of smart board. I love it.
The you very much Meneer

Participant D4

Ah Good afternoon

Background

1. How many years have you been using the smart board?

I start using the smart board I think three years.

2. How did you come to be interested in integrating smart board into your teaching?

Yah I think when I compare before we were using the chalk board. It was a little bit delaying then we would not complete the lessons but by using the smart board for now I think it's smooth and moving fast.

Understanding of Topic:

1. How does smart board instruction aid conceptual understanding differently?

Yah for the smart board I think when we teach I can give the learners from the smart board to explain about the circle. There are some options I can press and then the circle can appear there and different type of geometry figures so that learners can see. There are many types of pictures there Eh

2. In your opinion, what is the importance of smart board? What role does it play in today's teaching?

Yah I think the importance of smart board is because it just a new technology that we are using now. Everything even the learner who does not have access to laptop or computer and learners most of the time when we send them to the smart board they can also get the access to use the computer. Eh that is very important.

Roles:

Eh some of the roles we get from the computer then there Eh. One of the roles… the most Eh... Some of the options we find here. Eh … options like saving, Yah downloading, check also the emails. Eh down load videos. Sometimes we connect from the laptop to the video. Something like that

3. How were you introduced to the interactive whiteboard? Did you receive official training? How did you learn how to use it/integrate it?

Yah the time they introduced these smart boards and then just after two months there were those instructors that came to train us. Then it takes something like three months and then after that we complete the training... Yah we were doing practicals when the instructor was here and Eh sometimes she used to send us to the board and show us what she was telling us and teacher by teacher to go and show what we have to do. Like the first thing to do was just writing Yah to write when there are some of the options here you press the button at the top. Not the button…. We touch because we are using touch screen and then writing and erasing. Those were very very important because as a teacher as you have to know how to press where there is a pen so that you can when you make a mistake you can erase and Eh what was very very enjoyable was the colour. We have got the red colour blue and yellow colour.

Benefits:

1. What are some benefits have you found in integrating smart board technology into your regular lesson instruction?

I think the benefits we got. Eh it make train to be faster in using IT. So we learn more from the smart board also. Eh most of the time when we…there is a connection from the laptop to the smart board

2. Is the smart board a large part of your teaching? If yes, how?

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
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Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
Copyright:
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Yeh I can also say yes but because teaching most of the time we use the books. Sometimes I can open the book and explain to my learners and I can see there is a delay when I press the button to download a book there to check from page to page from smart board. But because using the hard copy is very fast than the smart board because there is also a problem of freezing you see sometimes it is getting freeze and you have to wait and you can continue.

3. Does smart board use enable a productive pace in the lesson?

Yah yes I can say yes but sometimes it is delaying because the smart board sometimes when you write some things to to give to our learners…There is a delay because sometimes you write and wait for the learner to finish before you move to the next page. Then you see the chalkboard before you… you write on one side. Yah sometimes the lesson is going fast. Let's hope with technology next time they will develop a bigger one.

Strategies:

1. How does smart board instruction aid different learning styles?

Yah we can tell so from learning styles learners can learn in a democratic way Democratic way because the smart board is giving learners that attention that the chalk board because I can also make interest to learners to be in that democratic learning. That democratic learning so that they can be very interesting and focus towards what we are learning

2. Can you provide some examples of lessons you have done with the assistance of a smart board?

Ehm…. Most of the lessons as a maths teacher they are very interesting like when I teach Algebra, Trigonometry and Geometry. Also because while studying about Geometry there are some options when we touch there on the smart board and learners can see what we are saying.

3. Which curriculum area do you feel the smart board is most beneficial for? Why?

Yah there is a Those subjects that are beneficial for smart boards especially Maths and Eh Accounting and Science all of them they are very very very quick for smart board when we are teaching.

4. How can this piece of technology be integrated across all curriculum subjects?

Yes, but languages just to write. We just write on the board. Like those ones I mentioned before the smart board is very very key.

5. Do you use smart boards with other modes of instruction?

Yah Like I told you from the beginning there are also books from the smart board that you down load. You can also down load some question papers and solutions and sometimes they used to be connected from their tablets especially Grade 12

Perceived Student Impacts:

1. Does the way you use smart board technology enable interactivity? How?
2. From what you have observed, how have your students reacted to learning through a smart board?
3. In your opinion, how can a smart board benefit student academic learning?

Um Yah the benefits is just about the new knew technology where they can learn many things. Eh what they can apply to the computer while in class. They can benefit from what you are telling especially in Mathematics. Yah learners are connected to the internet and they can also sometimes go to the lab. There are other teachers teaching IT to help and they come to class to apply it also through the smart board. Yes, the smart board is connected to Wi-Fi because when you check here we have those icons from the computer if you want to go to Google you can from the smart board or you can send emails. Also it's a computer because there is a memory just like the computer

Challenges:

1. Are there any limitations when using smart board for lesson instruction? If so, what are they?

Eh most of the challenges is freezing. Eh like most of the time before the bell rings the smart board can freeze and it's a technical problem. Most of the time we used to press it off and we can restart again. You can see what you wrote and then you can still stay on the work.

2. Have you experienced any trouble with interactive smart board? If so, how did you overcome this challenge?

Eh for now I think the big challenge is freezing.

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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3. If I asked you to name the most challenging thing regarding the integration of smart board into your lesson instruction, what would it be?

Yah according to the new technology I think it's better for all the teachers to use technology

Conclusion:

1. Would you suggest that all teachers start to integrate this technology into their regular lesson instruction? If yes, why? If not, why not?

Yah there is support from the labs… From those teachers that are teaching IT. When we a problem they used to come and assist.

Anything else

Not much to say but like I said before. Freezing and also no electricity. Like when you are teaching the power goes off. You get stuck because there is no option to go back to the use of chalk board. So what we do during that time is to give them some work to write and they write it until the power is back

2. In your opinion, is there enough support for the use of this technology in your school?
3. Do you have any final comments or opinions in relation to integrating smart board technology into regular lesson instruction?

Appendix F: ATLAS.ti coding reports

1 Project: Simbarashe

Code Report

(5) codes

Local filters:

Theme 1: Smart board benefits for teaching

○ **Smart board and curriculum benefits**

4 Quotations:

1:10 I think for all subjects. Yah I think for example in Maths Neh. It's …… (4000:4376) - D 1: Interview participant 1_3 years experience

I think for all subjects. Yah I think for example in Maths Neh. Its … I think in Maths like you can up load a lot of activities that the learners will be able to do and you can switch from one book to another on the smart board unlike having come with a lot of textbooks and paging through activities is difficult unlike just using the smart board. So like all subjects can fit

2:10 Curriculum think most content and I can say may be geo because I know…… (2970:3161) - D 2: Interview participant 2_1 year experience

Curriculum think most content and I can say may be geo because I know more about that. There are some diagrams. There some conventional signs whereby learners can see them from the smart board

2:12 Pictures Visuals Mostly writing (3628:3658) - D 2: Interview participant 2_1 year experience

Pictures Visuals Mostly writing

4:10 Those subjects that are beneficial for smart boards especially Maths a…… (4850:5026) - D 4: Interview participant 4_3 years experience

Those subjects that are beneficial for smart boards especially Maths and Accounting and Science all of them they are very quick for smart board when we are teaching

---

○ **Smart board benefits and the importance for teaching**

6 Quotations:

1:3 nowadays everything is about technology. So I think smart board is …… (821:1068) - D 1: Interview participant 1_3 years experience

Nowadays everything is about technology. So I think smart board is very important. You can connect the internet. You can upload videos and they can see them whilst you not there. You can upload worksheets online and you can also access them at home

2:3 the importance of smart board is for learners to see what you are talk…… (1136:1255) - D 2: Interview participant 2_1 year experience

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The importance of smart board is for learners to see what you are talking about and again it reduces the use of papers.

2:4 I think as times goes whereby learners are able to use …what do you …… (1322:1449) - D 2: Interview participant 2_1 year experience

I think as times goes whereby learners are able to use …what do you call it... not computer...tablets. It reduces teachers work

3:1 It makes teaching very easy and very interactive. You can show learner…… (424:536) - D 3: Interview participant 3_3 years experience

It makes teaching very easy and very interactive. You can show learners videos... Videos with real life situation

3:5 I said you save your work on smart board. Tomorrow you find it there a…… (1259:1423) - D 3: Interview participant 3_3 years experience

I said you save your work on smart board. Tomorrow you find it there and you can still refer to them nothing is being erased there You know that your work stays safe

4:3 I think the importance of smart board is because it just a new ….(978:1291) - D 4: Interview participant 4_3 years experience

I think the importance of smart board is because it just a new technology that we are using now. Everything even the learner who does not have access to laptop or computer and learners most of the time when we send them to the smart board they can also get the access to use the computer. That is very important

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○ **Smart board benefits for lesson instruction**

5 Quotations:

1:6 hat application that you use… Its notes what Eh yes smart tutor Neh. L…… (1788:2248) - D 1: Interview participant 1_3 years experience

hat application that you use… Its notes what Eh yes smart tutor Neh. Like you can just do like you know if you want to have an activity with learners… You want them to match a certain concept to a definition. So you can hide the concept and learners can come and drag the concept and match with a picture or a concept and you can also do activities that are interactive. They can also watch some videos and they can answer the questions from watching a video

1:11 h listening, visual, and then learners can also come and match concept…… (4440:4510) - D 1: Interview participant 1_3 years experience

h listening, visual, and then learners can also come and match concepts

2:7 some of the boards they did install different books for learning (2213:2276) - D 2: Interview participant 2_1 year experience

some of the boards they did install different books for learning

4:5 I think the benefits we got. Eh it make train to be faster in using IT…… (2755:2954) - D 4: Interview participant 4_3 years experience

I think the benefits we got. Eh it make train to be faster in using IT. So we learn more from the smart board also. Eh most of the time when we…there is a connection from the laptop to the smart board

4:12 from the beginning there are also books from the smart board that you…… (5317:5533) - D 4: Interview participant 4_3 years experience

from the beginning there are also books from the smart board that you down load. You can also down load some question papers and solutions and sometimes they used to be connected from their tablets especially Grade 12

○ **Smart board integration into teaching different subjects**

6 Quotations:

1:5 Because teach CAT like I said It's about this interactive smart …… (1452:1654) - D 1: Interview participant 1_3 years experience

Because teach CAT like I said It's about this interactive smart board, using tablets and technology basically for teaching so in everything I do If I am not using my laptop I am using the smart board

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2:6 its very interesting and there is that saying "tell me forget show…… (1736:2066) - D 2: Interview participant 2_1 year experience

it's very interesting and there is that saying "tell me forget show me I will remember "So if for example a teacher is busy teaching primary economic activities Eh for example the use of a tractor and when the learner see that from the smart board then they will be able to differentiate between primary and secondary activities

2:11 I do not think they are using it all of them like there are some …… (3247:3569) - D 2: Interview participant 2_1 year experience

I do not think they are using it all of them like there are some educators that are not in the know-how of using smart board like myself. May be there many teachers out there that are still using the smart board for writing purposes only. They cannot take the lesson plans out of the smart board or training should be done.

3:4 My work is always safe in the memory stick. I normally download some s…… (991:1126) - D 3: Interview participant 3_3 years experience

My work is always safe in the memory stick. I normally download some staff on memory stick and use it on smart board. No more paper work

4:6 I can also say yes but because teaching most of the time we use the …… (3024:3470) - D 4: Interview participant 4_3 years experience

I can also say yes but because teaching most of the time we use the books. Sometimes I can open the book and explain to my learners and I can see there is a delay when I press the button to download a book there to check from page to page from smart board. But because using the hard copy is very fast than the smart board because there is also a problem of freezing you see sometimes it is getting freeze and you have to wait and you can continue

4:11 languages just to write. We just write on the board. Like those ones I…… (5118:5237) - D 4: Interview participant 4_3 years experience

languages just to write. We just write on the board. Like those ones I mentioned before the smart board is key

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○ **Smart board lesson examples**

8 Quotations:

1:9 Like Microsoft applications such as Microsoft excel or PowerPoint. It'…… (3284:3909) - D 1: Interview participant 1_3 years experience

Like Microsoft applications such as Microsoft excel or PowerPoint. It's much easier when you do it step by step while the learners are also doing it from their PCs. So a smart board is basically like a computer but a bigger one in the classroom. You can click there and the learners can do whatever that you are doing. So a smart is very important when you are doing practical lessons. And this other time I was… Instead of like explaining the whole lesson I just make the learners watch a video and then before watching the video they just did an activity on their own. At the end of the day they report on the whole lesson

2:9 Population Geography (2869:2888) - D 2: Interview participant 2_1 year experience

Population Geography

3:6 I teach Geography. I have been doing Map work with them I have been …… (1505:1759) - D 3: Interview participant 3_3 years experience

I teach Geography. I have been doing Map work with them I have been synoptic weather maps. You can enlarge some pictures. You can do whatever you want with pictures. You can still write on the same material using smart pen. Yah it's very easy to work with

4:9 Most of the lessons as a maths teacher they are very interesting like…… (4490:4752) - D 4: Interview participant 4_3 years experience

Most of the lessons as a maths teacher they are very interesting like when I teach Algebra, Trigonometry and Geometry. Also because while studying about Geometry there are some options when we touch there on the smart board and learners can see what we are saying

5:1 The lesson was how to present statistical data in the form of …… (330:1110) - D 5: Lesson observation transcripts

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The lesson was how to present statistical data in the form of frequency polygons as well as histograms. The educator demonstrated the steps on how to draw frequency tables, mid points as well as class intervals. Learners did calculations of mid points while the educator enter them on the frequency table as well as draw the graphs following the educator's demonstrations on the smart board. Later, some learners were invited to demonstrate to other learners their understanding of the process. Learners were also given an activity from the textbook. The activity was later marked by the learners themselves. Collaboration by exploring affordances of smart boards such as the use of online searches and the use of project based approaches were not witnessed much during the lesson.

5:2 Grade 11 Geography map work lesson that was presented with aid of the…… (2117:3048) - D 5: Lesson observation transcripts

Grade 11 Geography map work lesson that was presented with aid of the smart board. The educator accessed the lesson from a memory stick. Learners were asked to sit in groups of threes whilst sharing some maps. Some past examination paper questions were that were prepared in word format were given to learners in the form of slides. At least some team work was witnessed as learners were discussing the map work concepts. This gave the educator an opportunity to move around checking for progress and guiding learners. Upon ending of the lesson, the educator saved the revision on the smart board. Visuals were used to illustrate some of the desired map work skills. Towards the end of the lesson learners had to assess their work using a memorandum that was presented on the smart board The smart tutor application was used for illustration purposes. Learners were also coming upfront to illustrate some answers on the smart board.

5:3 This was a Grade 10 Computer Applications and Technology (CAT) lesson…… (3911:4376) - D 5: Lesson observation transcripts

This was a Grade 10 Computer Applications and Technology (CAT) lesson on typing as well editing of a contents page. The lesson took place in the Computer Laboratory. Each learner was sitting behind a PC. The educator demonstrated and gave instructions using the smart board. Learners concurrently practiced the word application skills such how to edit and separate headings from the contents page on their PCs. Towards the end of the lesson learners saved their work

5:4 The lesson focused on effects of maritime pollution on both human …… (5431:6044) - D 5: Lesson observation transcripts

The lesson focused on effects of maritime pollution on both human beings as well as marine life. The educator used the smart tutor application for writing purposes. Learners were given the opportunity to discuss some of the desired concepts through interacting with the smart board. However, in terms of smart board multimodality not much was observed since the educator did not use most of the applications such as visuals, highlighting, shading and so on. Again, although the educator was the one who did most of the talking the lesson was generally interactive as the educator and learners exchanged information.

2 Project: Simbarashe

Code Report

(4) codes

Local filters:

Theme 2: Smart board benefits for learning

- **Smart board and interactivity and learner responses**

6 Quotations:

1:12 Yes, it does because most of the time it's all about engaging the learn…… (4584:4778) - D 1: Interview participant 1_3 years experience

Yes, it does because most of the time it's all about engaging the learners. You don't have to be… The teacher doesn't have to be in control all the time. The learners can also do most of the work

1:13 They react very well and actually like the disciplined and behaved when…… (4880:5301) - D 1: Interview participant 1_3 years experience

They react very well and actually like the disciplined and behaved when you actually use smart board because it is not something they are used to. So they become interested to know what is happening

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Article History:
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and the lesson also becomes funnier to them because like when you are writing on the chalk board they might be talking and not concentrating on what you are saying so the smart board can keep them engaged most of the time

2:13 No not much because I am not in the position take or show different co…… (3759:3895) - D 2: Interview participant 2_1 year experience

No not much because I am not in the position take or show different conventional signs in Geography. I still needs more workshops on that

2:14 most of them they are interested in that (4005:4044) - D 2: Interview participant 2_1 year experience

most of them they are interested in that

3:9 They enjoyed it a lot because even if you are not at work you can give…… (2341:2473) - D 3: Interview participant 3_3 years experience

They enjoyed it a lot because even if you are not at work you can give them work you on a stick or you save work for next coming day.

4:13 he benefits is just about the new knew technology where they can learn…… (5813:6476) - D 4: Interview participant 4_3 years experience

he benefits is just about the new knew technology where they can learn many things. Eh what they can apply to the computer while in class. They can benefit from what you are telling especially in Mathematics. Yah learners are connected to the internet and they can also sometimes go to the lab. There are other teachers teaching IT to help and they come to class to apply it also through the smart board. Yes, the smart board is connected to Wi-Fi because when you check here we have those icons from the computer if you want to go to Google you can from the smart board or you can send emails. Also it's a computer because there is a memory just like the computer

- **Smart board benefits for effective academic learning**

4 Quotations:

1:14 I think I think it benefits them very well because like with a smart b…… (5383:5799) - D 1: Interview participant 1_3 years experience

I think I think it benefits them very well because like with a smart board you can use more activities that can be to the advantage of the learner unlike using an explanation just in the textbook. They can be able to relate like seeing a picture and be able to understand what you are talking about unlike just a lot of information. Yes, so on a smart board you can make fun for learners to be able to understand.

2:15 in the long run with the use of their tablets and the teacher using…… (4137:4349) - D 2: Interview participant 2_1 year experience

In the long run with the use of their tablets and the teacher using the smart board and marking can be done through the smart board Eh connected with their laptops can reduce more work on the part of the teacher

3:10 its interactive learning they get to see like in the past they used to…… (2562:2717) - D 3: Interview participant 3_3 years experience

its interactive learning they get to see like in the past they used to see volcanoes in the textbook. So kids can see the real deal unlike seeing it on paper

4:13 The benefits is just about the new knew technology where they can learn…… (5813:6476) - D 4: Interview participant 4_3 years experience

The benefits is just about the new knew technology where they can learn many things. what they can apply to the computer while in class. They can benefit from what you are telling especially in Mathematics. Yah learners are connected to the internet and they can also sometimes go to the lab. There are other teachers teaching IT to help and they come to class to apply it also through the smart board. Yes, the smart board is connected to Wi-Fi because when you check here we have those icons from the computer if you want to go to Google you can from the smart board or you can send emails. Also it's a computer because there is a memory just like the computer

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○ **Smart board for productive lesson pace for different learning styles**

7 Quotations:

1:7 You can save time if you want to display a lot of notes. You can come…… (2409:2687) - D 1: Interview participant 1_3 years experience

You can save time if you want to display a lot of notes. You can come prepared just like display them on the smart board and just edit there and there unlike having to rubout the whole information from the board and start again so it's easier you just type and getting on with it

1:8 I think like the smart board was created for every subject. You can us…… (2773:3094) - D 1: Interview participant 1_3 years experience

I think like the smart board was created for every subject. You can use the learner centred approach. When learners… whereby the learner is the one who works there on the smart board. Learners like by themselves interacting with the smart board or you can just upload whatever you want and the learners can do the homework

2:8 I am not conversant with the use of the smart board I am just using it…… (2544:2715) - D 2: Interview participant 2_1 year experience

I am not conversant with the use of the smart board I am just using it to write. I am not able to use the USB so that questions are there. So I am just using it for writing

3:7 All of them especially … all of them. It enhances our computer usage.…… (1822:1952) - D 3: Interview participant 3_3 years experience

All of them especially … all of them. It enhances our computer usage. Yah you gain a lot of things from using the smart board daily

3:8 If they could just Eh train all the all the educators for all learning…… (2031:2239) - D 3: Interview participant 3_3 years experience

If they could just Eh train all the all the educators for all learning areas. If all the learning areas are downloaded onto the smart board I think it going to be good for us to integrate it in all learning areas

4:7 I can say yes but sometimes it is delaying because the smart board …… (3542:3956) - D 4: Interview participant 4_3 years experience

I can say yes but sometimes it is delaying because the smart board sometimes when you write some things to give to our learners…There is a delay because sometimes you write and wait for the learner to finish before you move to the next page. Then you see the chalkboard before you… you write on one side. Yah sometimes the lesson is going fast. Let's hope with technology next time they will develop a bigger one

4:8 we can tell so from learning styles learners can learn in a democratic…… (4040:4388) - D 4: Interview participant 4_3 years experience

we can tell so from learning styles learners can learn in a democratic way Democratic way because the smart board is giving learners that attention that the chalk board because I can also make interest to learners to be in that democratic learning. That democratic learning so that they can be very interesting and focus towards what we are learning

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○ **Smart board instruction and conceptual understanding**

3 Quotations:

1:2 It assists like very much because you can play videos. It's much more…… (574:707) - D 1: Interview participant 1_3 years experience

It assists like very much because you can play videos. It's much more interactive unlike using traditional green board and white board

2:2 even though I am not conversant with using smart board but the …… (749:1030) - D 2: Interview participant 2_1 year experience

even though I am not conversant with using smart board but the knowledge that I have I see smart board being an instrument that is more interesting towards learners as compared to the use of may be white board years back. So nowadays there the use of smart board is more interesting

4:2 for the smart board I think when we teach I can give the learners from…… (579:869) - D 4: Interview participant 4_3 years experience

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for the smart board I think when we teach I can give the learners from the smart board to explain about the circle. There are some options I can press and then the circle can appear there and different type of geometry figures so that learners can see. There are many types of pictures there

3 Project: Simbarashe
Code Report
(2) codes
Local filters:
Theme 3: Smart board challenges in schools

○ **Smart board challenges: limitations**
7 Quotations:
1:15 Sometimes there are because may be the smart board is not working prop…… (5921:6206) - D 1: Interview participant 1_3 years experience
Sometimes there are because may be the smart board is not working properly or you may have uploaded your work and is deleted. Sometimes the learners are able to access the password and can temper with the smart board. So those are challenges that we experience but in general it's normal
1:16 The most challenging thing that the learners. … Sometimes they don…… (6497:6809) - D 1: Interview participant 1_3 years experience
The most challenging thing that the learners. … Sometimes they don't know like where to touch and... but as for me the educator … because I am teaching CAT I know computers I do not have any problems. The only problem is when be if we knew how to fix it ourselves… Eh Yes. But in general everything is perfect
2:16 sometimes they freeze you won't be able to teach or if there is load s…… (4465:4541) - D 2: Interview participant 2_1 year experience
sometimes they freeze you won't be able to teach or if there is load shedding
2:17 there are a lot of challenges that I have experienced. I did not manage…… (4809:5006) - D 2: Interview participant 2_1 year experience
there are a lot of challenges that I have experienced. I did not manage to solve them hence I need more training. To overcome that I f I cannot use the smart board I can use the white board to write
3:11 Not I know of. As long as you are computer literate you can be able to…… (2829:2967) - D 3: Interview participant 3_3 years experience
Not I know of. As long as you are computer literate you can be able to manoeuvre the smart board. It needs competence in computer literacy
4:14 most of the challenges is freezing. Eh like most of the time before th…… (6590:6862) - D 4: Interview participant 4_3 years experience
most of the challenges is freezing. Eh like most of the time before the bell rings the smart board can freeze and it's a technical problem. Most of the time we used to press it off and we can restart again. You can see what you wrote and then you can still stay on the work
4:17 no electricity. Like when you are teaching the power goes off. You get…… (7608:7856) - D 4: Interview participant 4_3 years experience
no electricity. Like when you are teaching the power goes off. You get stuck because there is no option to go back to the use of chalk board. So what we do during that time is to give them some work to write and they write it until the power is back

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○ **Smart board: support for technology use**
3 Quotations:
1:18 there is because there is an ICT committee that I am part of and …… (7453:7724) - D 1: Interview participant 1_3 years experience
there is because there is an ICT committee that I am part of and sometimes we offer like help to assist the educators but the problem is that their old educators who do not want to attend because they feel inferior like towards the use of smart boards. So support is there

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2:19 there is because there is a teacher who is in the know-how and is prep…… (5423:5544) - D 2: Interview participant 2_1 year experience

there is because there is a teacher who is in the know-how and is prepared to help and is willing to train and help others

3:13 yes. It depends with individual teacher If you are ready to go for …… (3301:3573) - D 3: Interview participant 3_3 years experience

yes. It depends with individual teacher If you are ready to go for training. That training was conducted the whole of first and second term. It's up to individual teachers to attend if they are really interested. Getting ourselves developed through the use of a smart board

4 Project: Simbarashe

Code Report

(3) codes

Local filters:

Theme 4: Smart board training and the future

○ **Smart board interest**

4 Quotations:

1:1 while I was doing my practical's. because I am teaching CAT…Like… U…… (233:443) - D 1: Interview participant 1_3 years experience

while I was doing my practical's. because I am teaching CAT…Like… Using smart boards and tablets was a big part of my teaching and learning. So I started using the smart board while I was doing my practical's.

2:1 earners can be able to see them while you are using the smart board be…… (393:635) - D 2: Interview participant 2_1 year experience

earners can be able to see them while you are using the smart board because I can see that when you are using the smart board… Because I can see that when learners see something from the smart board they at least… they can be able to remember.

3:14 I love it. I love the use of smart board. I love it. (3701:3752) - D 3: Interview participant 3_3 years experience

I love it. I love the use of smart board. I love it.

4:1 I think when I compare before we were using the chalk board. It was a…… (272:472) - D 4: Interview participant 4_3 years experience

I think when I compare before we were using the chalk board. It was a little bit delaying then we would not complete the lessons but by using the smart board for now I think it's smooth and moving fast

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○ **Smart board training**

5 Quotations:

1:4 I did not receive any training it's my first year of teaching. so I fa…… (1210:1358) - D 1: Interview participant 1_3 years experience

I did not receive any training it's my first year of teaching. so I familiarise myself with the smart board whilst I was doing my teaching practical's

2:5 we did attend training for interactive whiteboards (1591:1640) - D 2: Interview participant 2_1 year experience

we did attend training for interactive whiteboards

3:2 After noticing that you can save your files there nothing gets rubbed…… (675:747) - D 3: Interview participant 3_3 years experience

After noticing that you can save your files there nothing gets rubbed off

3:3 we were trained by some officials there (846:884) - D 3: Interview participant 3_3 years experience

we were trained by some officials there

International Journal of Educational Studies
Volume 5, Issue 2, pp. 27-87.
2022
DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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4:4 he time they introduced these smart boards and then just after two mon…… (1728:2625) - D 4: Interview participant 4_3 years experience

he time they introduced these smart boards and then just after two months there were those instructors that came to train us. Then it takes something like three months and then after that we complete the training... Yah we were doing practical's when the instructor was here and Eh sometimes she used to send us to the board and show us what she was telling us and teacher by teacher to go and show what we have to do. Like the first thing to do was just writing Yah to write when there are some of the options here you press the button at the top. Not the button…. We touch because we are using touch screen and then writing and erasing. Those were very important because as a teacher as you have to know how to press where there is a pen so that you can when you make a mistake you can erase and Eh what was very enjoyable was the colour. We have got the red colour blue and yellow colour

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○ **Smart board: suggestions for teachers**

7 Quotations:

1:17 Yes I would because like you can see how technology is developing …… (6968:7356) - D 1: Interview participant 1_3 years experience

Yes I would because like you can see how technology is developing these days from now you will be able to realise that may be like in ten years' time. … Technology will be advanced so that teachers should be able to use the smart board starting now because you do not know in the future like the many advances that are going to happen. So I encourage all the teachers to use technology

1:19 If they get rid of textbooks everything become ICT, the use of smart b…… (7890:8271) - D 1: Interview participant 1_3 years experience

If they get rid of textbooks everything become ICT, the use of smart board will be more utilised and also because now most educators are still using textbooks instead of smart boards which benefits the learners there must be a policy may be in place that will say no more textbooks, let's focus on ICT and like... It also makes the work so easier. You know paperless means no stress

2:18 there should... because it is very interesting towards the learners.…… (5187:5319) - D 2: Interview participant 2_1 year experience

there should... because it is very interesting towards the learners. For example, some of the lessons can be taught using PowerPoint

2:20 if the SMT can make it compulsory to teachers to use the smart board p…… (5778:5870) - D 2: Interview participant 2_1 year experience

if the SMT can make it compulsory to teachers to use the smart board pass rate might increase

3:12 The sooner the better because forward we go with technology. Down with…… (3124:3205) - D 3: Interview participant 3_3 years experience

The sooner the better because forward we go with technology. Down with paper work.

4:15 according to the new technology I think it's better for all the …… (7165:7254) - D 4: Interview participant 4_3 years experience

according to the new technology I think it's better for all the teachers to use technology

4:16 there is support from the labs… From those teachers that are teaching…… (7414:7534) - D 4: Interview participant 4_3 years experience

there is support from the labs… From those teachers that are teaching IT. When we a problem they used to come and assist.

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DOI: *10.53935/2641533x.v5i2.246*
Email: smate100@uottawa.ca
Funding: *This study received no specific financial support.*
Article History:
Received: 21 September 2022
Revised: 4 November 2022
Accepted: 22 November 2022
Published: 9 December 2022
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