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The impact of interactive Smart boards on students' learning in secondary schools in Botswana: A students' perspective

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ABSTRACT

This study investigates the impact of the use of SMART boards on students' learning in schools in Botswana and is guided by the Context Input Process Product (CIPP) Evaluation Model. The study adopts a mixed methods design that employed interviews, observations and a questionnaire to obtain data. The results show that the use of the SMART boards enabled a variety of learning experiences that promoted students' engagement and interactivity, and increased levels of motivation and improvement in academic achievement. These findings indicate that SMART technologies have the potential to transform educational practices in Botswana, as it endeavors to provide its children with a quality education that matches the best global standards, and simultaneously recasts itself into an innovative, efficient and adaptive economy that can compete in the global world of the 21st century.

Keywords: *SMART boards, evaluation, student achievement, motivation and student engagement.*

INTRODUCTION

The Government of Botswana recognizes the importance of computer-based technologies in assisting to produce a human resource that is equipped with 21st Century skills, which can help the country transition from a mining-driven economy to a knowledge-based one. To this end, the government has equipped all secondary schools in the country with computers and introduced computer awareness programs in the curriculum to equip all learners with skills in computer technologies. Over time, several projects have been carried out in the schools by both government and non-government entities to try to enhance students' learning through technology (Isaacs, 2007; Tau, 2008). One such undertaking has been the SMART Technologies Pilot Project, which was meant to provide some of the latest technologies in the form of interactive SMART boards to some selected schools in the country for students and teachers to use in their classes. The purpose of this study then was to assess the impact of the use of these SMART technologies on students' learning, particularly from the students' perspective.

Evaluation of this program is critical because generally Botswana faces challenges of poor project implementation (Kaboyakgosi & Marata, 2013; Mathambo, 2015) and this has mainly been attributed to lack of monitoring and evaluation (BOPA, 2014; Botlhale, 2017; Kaboyakgosi & Marata, 2013). In the area of technology use in education alone, there has been a plethora of initiatives which have come and gone without any feedback or accountability on their effectiveness or lack thereof (Internet Learning Trust, 2000; Lenyatso, 2016; Mutula, 2002; Nleya, 2010; Tau, 2008). This has been detrimental to the development of educational technology in the country as initiatives do not build on to each other for progression. Zhao, Yan & Lei (2008) say that outcomes of one program evaluation should feed into the implementation of the next one so as to avoid repeating the same mistakes and to improve practice. Evaluating the effectiveness and appropriateness of ICT tools used in the classroom is an important aspect of integrating technology in the learning process. It is also crucial to establish the effects of technology in under-developed settings because they often have unique educational systems and contextual challenges different from what is often widely reported in the literature. As such, global technology advancements need

to be cognizant of such issues in the pursuit of closing the digital gap, as advocated for by the United Nations Sustainable Development Goals (Sustainable Development Goals, 2016). Furthermore, this study reports on the impact of the use of the SMART boards in learning, specifically from the students' perspective. Acquisition of 21st century skills necessitates education environments that are learner-driven. As such, it is important for students' voices to be heard in all aspects concerning their learning, including their opinions on the various innovations that are supposed to improve their studies. In this way, students become part of the decision-making process and this could assist to make appropriate adjustments that would be more beneficial to their learning.

The SMART Technologies Project

The project provided SMART boards, which are interactive whiteboards and their associated technologies, to five schools in Botswana to be used in learning for selected subjects. Each participating classroom was provided with the following SMART technology resources: SMART Board, SMART Ultra Short Throw Projector, SMART Audio System for Integrated Solution, SMART Response PE System with 32 Clickers and Receiver Set, SMART Document Camera and a SMART Podium. Table 1 below shows the selected subjects per school and the number of classes per subject that was allocated the use of the resources.

Table 1: *Selected Subjects for the Project per School and the Number of Classes Allocated the SMART Equipment*

School/Institution	Selected Subjects	SMART Equipment per classroom and subject
Senior Secondary School V	Maths, Chemistry, Physics, Social Studies	4 classrooms - one (1) per subject
Junior Secondary School W	Maths, Integrated Science, Social Studies	2 Classrooms – Integrated Science 1 Classroom – Maths 1 Classroom – Social Studies
Senior Secondary School X	Maths, Chemistry, Physics, Social Studies	4 classrooms - one (1) per subject
Junior Secondary School Y	Maths, Integrated Science, Special Education	2 Classrooms – Integrated Science 1 Classroom – Maths 1 Classroom – Special Education
College of Education Z	Computer Education	1 Classroom – Computer Education

The objective of the SMART Technologies Project was to try to enhance students' learning by providing a collaborative and engaging dimension to learning through utilization of the various features of SMART boards in the delivery of the lessons.

Participants in the SMART Technologies Project

The School Heads were mandated with the selection of participating classes and teachers. This selection was loosely based on whether or not the teachers had prior experience working with ICT in learning. Those teachers who were willing to be part of the project but had little or no computer experience were, however, allowed to participate. Teachers participating in the project were trained

through a series of workshops to prepare them for the use of the resources with the students. The teachers in turn trained their respective students, which was done simultaneously as the lessons were carried out. The project ran for a period of one year before this evaluation took place.

Assessment of the Project

This paper is part of a larger study whose purpose was to evaluate the effectiveness or otherwise of the use of SMART boards so as to provide feedback to decision makers on whether or not this venture was a worthwhile investment in the education system of Botswana. Overall, the evaluation had seven objectives, which covered a wide spectrum of critical issues that need to be considered when assessing the impact of a technology resource in education. However, the scope of this paper focuses only on those aspects that specifically dealt with students' learning from the perspective of the students themselves. The questions that the study sought to answer were:

- How did the use of the SMART boards and their associated technologies impact students' engagement and interaction in learning?
- What effects did the use of the SMART boards have on student motivation?
- How did the use of the SMART boards impact students' achievement?

LITERATURE REVIEW

Using Technology Effectively in Learning

The most important issue to address when evaluating the use of a technology tool in learning is how effectively it is being used by both teachers and students in the learning process. Many researchers have cautioned that the availability of technology in the classrooms does not necessarily translate into an effective use of the tools to enhance learning (Noeth & Volkov, 2004; Moeller & Reitzes, 2011). It is essential to assess whether the use of the tools brings any change to the way things are done. Utecht (2008) points out that one of the most important questions that we need to ask when considering technology use in learning is if the technology is creating new and different learning experiences for the students, or whether it is just helping them to do new things in an old way.

In his 'Leonardo's Laptop' book, Shneiderman (2002) presents a framework called 'Collect-Relate-Create-Donate' (CRCD) framework, which advocates for the alignment of technology tools to learning goals in order to assist teachers to effectively integrate technology in learning. The argument is that if technology tools are well integrated with appropriate objectives and goals, they can promote optimal learning through the use of technology. The framework calls for teachers to employ innovative teaching strategies that use technology as a tool for learning. Educators emphasize the importance of helping students interact with information in a new and meaningful way, and to give them an opportunity to create and share knowledge. As Gorder (2008) says, it is about time we move the use of technology to a deeper and more meaningful level within the classroom. The consensus is that the use of technology should transform teaching and learning and not just replace the traditional tools (Rana, Greenwood, Fox-Turnbull, & Wise, 2018; Salamon, 2002; Su, 2009; Williams, 2011).

Student Achievement

Student achievement is one outcome of technology use that most educators and parents are very interested in. If it can be proven that the use of a particular technology has increased students' performance, then the use of such a technology will be deemed beneficial (Johnson & Barker, 2002). Measuring the impact of a technology innovation on student achievement is however a

daunting task that presents an array of methodological challenges, raising questions about the findings obtained from the evaluations. Some of the common pitfalls of this process are using poor measurements of academic achievement to judge technology impact such as tests that have been developed for that particular study. Some studies fail to assign students to conventional environments that would enable them to make credible comparisons between students exposed to various interventions and those who have not been exposed.

Various studies have employed different methodologies to measure the relationship between technology and educational outcomes. The results vary according to the type of the assessment strategy used. Researchers agree that in order to ascertain that it is a technology intervention that has produced a particular gain in student achievement, it would require carrying out comprehensive longitudinal studies that would be able to control other variables to isolate technology as the cause of such a result. Such evaluative studies need to have both formative and summative assessments components and be conducted over considerable periods of time (Gulek & Demirtas, 2005).

Notwithstanding the short-comings in research methodologies and poor assessment measures, it is clear that, generally, research indicates that there is sufficient evidence that technology use in learning impacts educational outcomes. The use of technology in learning has been credited with assisting students to better comprehend and retain course material, develop basic skills and improve their attitude towards learning. According to the ISTE Policy Brief of 2008, ISTE members have monitored research on the impact of technology on student learning outcomes for more than 20 years and one convincing trend that has been observed is, "when implemented appropriately, the integration of technology into instruction has a strong, positive impact on student achievement" (Zhao, Yan, & Lei, 2008, p2). In Botswana, a meta-analysis of studies conducted to investigate the use of technology in schools in the country has identified various challenges and shortcomings facing the use of technology (Magetse, 1997; Busang & Oabile, 2000; Pender, 2007; Boitshwarelo, 2009). All the studies, however, point to the fact that technology impacts learning in a positive way and can play a crucial role in assisting the country to realize its vision for development.

Technology and Students' Motivation

Technology seems to provide a lot of excitement to a number of youths, learners included. This is evidenced by many youths owning at least a cellular phone and engaging in social media. On whether or not technology can positively affect learner motivation, literature attests to the positive effect. For instance, technology is perceived as a powerful tool that can benefit normal learners, learners with difficulties as well as the disabled (Eligi, & Mwantimwa, 2017). The audio aspect of technology, if used appropriately, can uplift learning by the blind learner; visual technologies can assist the deaf learner, while learning through social media or virtual classes could motivate those learners who cannot stand a physical classroom environment (Usher, 2009).

To capture the ideas of Norris and Lefre (2011) on the value of technology on motivation, technology has the capacity to encourage student-centered learning. According to Cheang (2009), a learner-centered approach is effective in the promotion of the efficacy of several domains of motivation such as critical thinking, meta-cognitive self-evaluation and problem solving. Technology is therefore, in this respect, a very critical catalyst of motivation.

In their study of a comparison between those learners who use the traditional approaches to learning and those using technology, Granito and Chernobilsky (2012) discovered that learners retain knowledge no matter which approach to learning they use (traditional or technological). They further noted that, while technology can be a powerful tool in education for those that have interest in it, it may act as a de-motivator for those who do not have an interest in it. The latter would, instead, perform better under traditional approaches. Francis (2017) however notes that proper use of technology can have enormous benefits in education. Therefore,

> "*a paradigm shift regarding appropriate implementation of technology in education is necessary to ensure a successful 21st Century classroom and to set up students for success in their future careers* (Francis, 2017, p. 55).

THEORETICAL FRAMEWORK

This study was guided by the Context Input Process Product (CIPP) Evaluation Model (Stufflebeam, 2004). This framework is helpful in evaluating technology integration projects as it takes a comprehensive look at such innovations as they occur in a particular setting. The model constitutes the following elements:

Context: According to this model, it is crucial to explore the environment in which a particular program is being implemented to find out how facilitative it is of the innovation. Factors to consider in a case as in this study are characteristics of the schools such as: size, location, technology infrastructure, access, support and the teaching and learning culture. Every setting has its unique characteristics which are going to affect the success of any project (Khan, 2005; Engwall, 2003) and taking this into consideration increases the chances of success for such a project (Chandrasekaran, Linderman & Schrorder, 2015).

Input: This refers to the human and financial resources of the program. Do the users have sufficient competencies to implement the project and are they motivated to do so? It is also crucial to establish the financial sustenance of the program.

Process: This alludes to the actual implementation of the project. How are the users really carrying out the activities? Monitoring is very crucial at this stage to ensure that the objectives of the project are being pursued. According to PMI (2013), more than one third of projects fail to reach their intended objectives. In the project at hand, the SMART boards are supposed to improve students' learning. Therefore, it is crucial to find out how exactly they are being utilized in the lessons, which would be an indicator of whether the overall objectives would be met or not. Implementation is also when unanticipated constraints surface (Dillon, 2019), thus requiring adjustments to be made to improve the success of the project. Process is also the stage to check whether the impact is visible and if it can be attributed to the innovation.

Product: This is the outcome of the project as measured against pre-determined success indicators. It is a measure of the impact of the project, which can be positive or negative. There is no one way to measure product because, as Mir & Pinnington (2014) state, they are multifaceted with various characteristics. Projects' success factors vary according to different stakeholders and also as per a dynamic global environment with priorities that are constantly changing and requiring continuous innovation (Salanta, Popa, 2014). So project results can take various forms such as: short-term or long-term, pre-conceived or unanticipated, abstract or substantive. In a project such as this study, the focus of interest is on how the project has impacted various aspects of students' learning? For example, has it improved their academic achievement and helped to create new forms of learning?

METHODOLOGY

Sampling

First, purposive sampling was used to select teachers and students to participate in this study. The teachers selected were those who had been trained and were using the SMART technologies in their lessons. However, there were also some teachers who, out of personal interest, were using the SMART boards with their students and these were also included. The students participating in the study were those belonging to the classes of the participating teachers. The study was

intentionally focused on students who had at least one-year experience in the use of SMART boards. The total number of students participating in the project was 450. There were 201 males and 249 females. The majority of the respondents (95%) were aged between 12 and 19, while 5% were aged between 20 and 27 years. From this group, convenience sampling was then used to observe and interview participants who were available and interested.

Study Design and Data Collection Strategies

This study adopted a mixed approach methodological design, which combined both qualitative and quantitative approaches to obtaining data. This was mainly for pragmatic reasons of bridging the gap created by deficits in either approach (O'Cathain, Murphy & Nicholl 2007). Table 2 below presents the various data collection strategies used to obtain data as guided by the theoretical framework of this study.

Table 2: *Data Collection Strategies*

Data collection method	Elements of the CIPP model	Nature of information sought
Observations	Context Process	Class observations were conducted to obtain first-hand information on how the SMART technologies were used in the lessons. An observation guide was used to help direct the observation on what kind of things to look out for in the sessions, for example, availability and level of access to resources, the types of learning activities carried out in the classroom, users' competencies, the level of students' engagement and the way they interacted with each other. However, emerging issues were also noted in the various classrooms.
Questionnaire	Input Product	Students responded to a self-fill-in questionnaire, which contained both quantitative and qualitative questions. The questions required students to record their perceptions regarding the use of SMART technologies on various aspects of their learning, such as their proficiency levels in using the tools, levels of motivation and participation in class.
Interviews	Process Product	Oral interviews were held with students, both at individual levels and in focus groups. The interviews were a follow up from the questionnaires to obtain in-depth information concerning the responses given in the survey. Here, participants provided their overall perceptions on the impact of the use of the boards on the various aspects of their learning.

Data Analysis Procedures

The Statistical Package for Social Sciences (SPSS) was used to analyze quantitative data. Data were subjected to mapping through frequencies on the descriptive statistics. Students' demographic data were provided; this included: gender, age, year/level of study. Descriptive statistics were used in the form of frequency tables to present categories of variables and percentages of the sample. In this process of mapping out the data through frequencies, one critical problem which emerged was that of missing data. Missing data were also detected by means of visual scanning. The researchers did not make average, or use list wise or pairwise deletion

methods for the reason that this was a small-scale evaluation of a pilot project that needed to be captured as is. Bivariate correlations between imperative independent and dependent variables were also conducted to determine the associations.

Qualitative data from open ended questions were coded and various themes were generated from the data. Answers were then all read through to find those responses which fitted each of the themes. Data from observations and interviews were also read through to pick up on common themes.

Ethical Considerations

Permission was sought from the Ministry of Education to access the participating institutions to carry out the study. At the institutional level, the school administration, the teachers and the learners were briefed by the research team on the project. Reference was made to the ministry's letter of permission. Informed consent was obtained from the participants and they were also assured of anonymity in the presentation of their responses.

RESULTS

Biographical Information

The total number of students who participated in the study was 450, 201 males and 249 females. The majority of respondents were aged between 12 and 19, while 20 participants were aged between 20 and 27 years. The participating students per level of study are as shown in Table 3 below.

Table 3: *Number of Participating Students per Level of Study*

Level of study	Number of students
Form 2	87
Form 3	129
Form 4	36
Form 5	174
Year 2 of college	24
Total	450

Access and Frequency of Use of SMART Boards by Students

The results show that 128 (28%) students indicated having frequent access to SMART board technology, while 41 (8%) had moderate access. In total, 36% indicated having moderate to frequent access, while 281 (62%) students indicated poor access to SMART technologies. The study revealed that those who reported satisfactory access were those who were somehow able to use the boards outside of scheduled class times, such as in the afternoons, something that was not possible for everybody. In terms of frequency of use, however, Table 4 below shows a good rate of use of the boards during lessons. The study sought to find out from students how often they used the boards in their lessons in a typical week.

Table 4: *Students' Views on Rate of Use of the SMART Boards*

Rate of Use	Frequency	Percent
Very regularly	152	33.8
Regularly	155	34.5
Occasionally	32	6.9
Did not comment	111	24.7
Total	450	100

Students' Engagement in Learning

This study found that various features of the SMART boards were used during lessons, which engaged students in different types of learning activities. In nine (9) out of the fourteen (14) lessons observed during this study, the SMART boards were used extensively to deliver different aspects of the curriculum. Examples of learning activities that students were engaged in included calculations, collaborative group presentations, building a product together, searching for extra information and students producing histograms on the boards. Students also did interactive quizzes where they would drag and drop items while answering questions, with input from the rest of the class. If the answer was incorrect, the item would refuse to be dropped in the box. Students also displayed a lot of confidence when they were performing various activities on the boards. In some classes, videos were played to demonstrate experiments and other processes. Students labelled items on the boards and simulated various concepts. For example, in one Chemistry lesson, the class simulated particle organization and movement in different states of matter (solid, liquid and gas) using the SMART board. The presentation showed particles moving in different directions as temperatures increased and decreased. Students reported that the capabilities of the SMART boards to present information in this visual manner greatly assisted them in understanding concepts better. This is captured in the following student's excerpt:

> "*The SMART boards make me easily see and understand the points that I read about. This is because they are shown in actual pictures*".

The students also reported that the use of the SMART boards gave them opportunities to participate more in class than they normally would in lessons where the boards were not used. This is seen in the following student quote:

> "*It is exciting to touch the screen and then information comes. Even when drawing a table, you simply press insert table and it does it for you. Most of us like volunteering to go and do work on the board. If all children were using this we would all pass very well because I believe I understand better*".

In the multiple correlation matrix of students' use, interaction, motivation and engagement, the correlation between students' use and engagement with the technology at N= 355 yielded a Pearson correlation coefficient of r= .887, p<.001, thus indicating an increased level of student engagement in learning when students used the technologies, even though it was at a minimal level of 12%. Students also indicated that the use of SMART boards enabled them to interact more with each other during the lessons. Seventy-six percent (76%) of the students indicated a moderate to high level of interaction with others when using SMART boards. These interactions took place both at small group level and with the entire class.

During class observations, in three of the classes that were effectively using SMART boards, there were power cuts during the lessons. Although unplanned, this was a welcome development in the study as it enabled the researchers to find out if the students would continue to be as actively engaged in the lessons as they were when using the SMART boards. Interestingly, the study found that as soon as the electricity went off, the dynamics of the classes changed. Students' participation was significantly reduced and the classes became more teacher-oriented. This made it clear that students' active participation could be attributed to the use of the SMART boards.

Nevertheless, in five (5) of the fourteen (14) classes observed, the use of the SMART boards did not seem to have any impact on the learning activities, as the instruction remained predominantly traditional. The interactive boards in these classes were used as ordinary white boards, with the teacher dominating their use and with limited participation from students. Further investigations revealed that the teachers who were teaching these particular classes were not part of the training program offered by the project at the beginning. Rather, they were shown by their peers how to use the system and some learned on their own, hence they were not well equipped to use the technologies optimally during the lessons.

The Use of SMART Boards and Students' Motivation

The impact of SMART boards' use on students' motivation was measured at various levels during the study. First, two procedures were performed, namely frequency descriptive statistics and the correlation matrix. To determine the levels of motivation three questions that captured the construct of students' motivation to learn were re-coded through transformation method to produce a new variable named "grouped student motivation level" with 'high, moderate and low' as descriptors. A total of three hundred and fifty one (351)(78%) students reported having a moderate to high level of motivation as a result of the use of SMART boards technology, while only eight (8) (2%) students reported having low motivation; ninety one (91) (20%) said the technology did not motivate them. In the multiple correlation matrix among students use, interaction, motivation and engagement, the correlation between motivation and engagement at N=348 resulted in $r = .303$, $p < .001$ indicating an increased level of engagement of 70% when students are motivated.

It was also noted during class observations that the various activities that students performed with the SMART boards seemed to excite them and got almost the whole class involved. The students reported that they actually looked forward to class when they knew the SMART boards would be part of the lesson. The students also reported that the boards improved their concentration in class, thus increasing their chances of grasping the learning content. Students indicated that the use of the SMART boards stimulated their interest in learning. When describing their experiences with the SMART boards in their lessons, they made statements such as, "It makes learning fun and enjoyable." "Helps to develop confidence." "Intriguing. It gives a good feeling." "Increases interaction with classmates."

Ease of Use and Skills Transfer

The majority of students in the study reported that they found SMART technologies easy to use, as shown in Table 5 below.

Table 5: *Level of Difficulty in Using SMART Technologies*

Level of difficulty	Frequency	Percent
Very easy to use	180	40
Easy to use	212	47
Difficult to use	51	11
Did not comment	7	2
Total	450	100

This ease of use was also demonstrated during class observations. Students were eager to come to the boards to perform various activities and displayed a lot of confidence in doing so. Students further reported that the use of boards helped to improve their overall computer technology competencies, such that they were able to transfer these skills to other lessons. As previously stated, the boards were meant to be used for specific subjects. However, the schools had computer awareness programs that were meant to facilitate computer use in various subjects across the curriculum. Students reported that they used the skills and knowledge they obtained from their SMART-based lessons in other subjects.

Impact on Students' Achievement

The majority of the students in this study reported that the SMART boards improved their learning and performance. Seventy-two (72) % of the students indicated that they performed better in subjects where the SMART boards were used. This is shown in Figure 1 below:

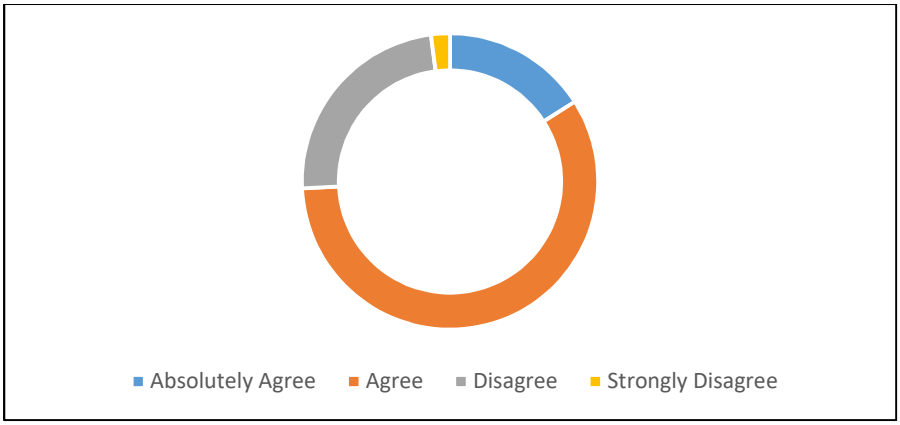

Figure 1: *Improved performance as a result of SMART board use*

The students pointed out that the use of the SMART boards helped them to understand and to remember things better, hence to help them achieve better results in their assessments.

DISCUSSION

The purpose of this study was to assess the impact of SMART boards on various aspects of students' learning. The study reported frequent use of the boards by students during learning. In addition, the participants reported and demonstrated ease of use of the boards. This shows that the students in this study, like many of their peers around the world, possess characteristics of a

net-generation who easily learn and are able to use computer-based technologies. The challenge then is for teachers to ensure that they channel the use of such tools in an effective way that can enhance learning. This reported ease of adoption by the users is a major predictor of effective and sustained use of the tools in the learning environment as previous studies have indicated (Park**,** 2009; Teeroovengadum, Heeraman & Jugurnath, 2017). Nevertheless, even though students reported frequent use of the boards during their lessons, the study indicated that they were not satisfied with the overall level of access to the technologies. The boards were used only during lessons for specific subjects and this finding shows that generally, students yearned for more access to the resources. The issue of access is a perpetual problem in developing countries (Antonio, 2014; Luxton, 2016; Samuel, Onasanya, & Yusuf, 2019; West, 2015). This study therefore implores such places to look into alternative ways of widening students' access to technology resources, such as the use of portable devices installed with the required software that could be used in different locations to supplement the use of stationery tools like SMART boards.

The findings of this study showed that the use of various functions of the SMART boards enabled students to engage in different learning activities during the lessons. This facilitated students' participation in class, empowering them to play a more active role in their learning. The importance of students' engagement in learning cannot be over emphasized. In fact, in today's education world, the extent to which students are engaged during the delivery of a lesson has become one of the key measures of effective teaching. As students participate in various activities, this helps them interact more with the content, hence improving their chances of understanding it more (Dallimore, Hertenstein, & Platt, 2017; Tang, 2006). In Botswana, the education system has been heavily criticized over the years for being too teacher-centered and not promoting students' active participation in learning (Otukile-Mongwaketse, 2018). As such, incidents of learning experiences that actively involve students, such as those reported in this study, are positive developments as they point to a paradigm shift from teacher-centered pedagogies to more learner-centered ones. Currently, a strategic plan to reform the education system in the country has been developed and one of its major goals is to improve the quality of learning through adoption of cutting-edge pedagogies that are learner-driven (Republic of Botswana, 2015). It is clear that the use of resources such as the SMART boards could contribute significantly towards achieving this goal. In this study, the activities that students were reported to be engaged in ranged from low order educational experiences to ones that were highly participatory and which simulated real life situations. According to Scott (2015), these experiences promote the acquisition of high order skills such as critical thinking, analysis, creativity and evaluation, which are 21st century skills, and are highly desired in the newly-envisioned education system in Botswana. Also, as students perform these activities, they become physically engaged, ensuring that they do not spend all of the time in class sitting at their desks. This is important to learning and has been linked to educational and health benefits for students (The conversation, 2013).

When technology was first introduced in learning, worldwide, one of its promises was the potential to actively engage students through enabling an array of learning activities that could help students comprehend content better. Several studies have tested this claim and investigated the impact of technology on students' engagement with the use of various tools in learning (Ang & Wang, 2006; Fovet, 2009; Sankey, Birch & Gardiner, 2010). These studies have been conducted at all levels, from primary through tertiary level, and they all concur that technologies provide the use of tools which capture students' attention and keep them actively engaged in the lessons. It is clear that the results of this present study are consistent with the rest of the literature on the impact of technology on students' engagement and learning.

The students in this study indicated that the use of the various features of the SMART boards, such as videos, images, and simulation tools, enhanced their understanding of the learning material. This was because the boards enabled the presentation of content in a visual form, making concepts clearer and as close to reality as possible. Examples of activities indicated in this study, such as

students simulating the effect of heat on particle movement in matter, is a good example of bringing learning from the abstract to a more realistic form. The curriculum in Botswana has been described as being abstract, so technology-enabled learning activities such as these can greatly assist in making learning content more concrete. The SMART boards, for instance, allowed for multiple presentation of content that engaged various senses, thus ensuring that all aspects of learning were being taken care of. Pitts (2012) concludes that learning is a multi-sensory activity and students benefit most when more senses are engaged, as this allows more cognitive connections with concepts and improves retention of information. Therefore, it is crucial for education systems to make all efforts to ensure their learning processes are as close to reality as possible. The presentation of information through various formats as reported in this study also addresses students' different learning styles, something that has been difficult to achieve through the normal teaching practices in the schools. The bottom line is that children have different learning styles and needs, and it is crucial that the tools used in the classrooms address all these. Moreover, the interactive tools in the boards, such as interactive quizzes, also assisted teachers and students with immediate feedback, which is helpful in identifying problem areas that need further attention. According to the CIPP model, this feedback is imperative for program adjustments during the implementation process.

This study also reported high levels of interactivity among the students in their lessons through collaborative learning activities, both at small group and at the entire class level when the SMART boards were used. This finding was not a surprise because the 21st century has brought along tools that have revolutionized the way people interact with each other. Bringing these tools to the classroom inadvertently means bringing those effects to the learning process itself. Studies show that the use of interactive tools such as communication forums, simulations and gaming, interactive assessment and group collaborative projects have encouraged student interaction in class in an unprecedented manner (Bradley & Lomicka, 2000; Marshall, 2002) and this study was no different. The Ministry of Education in Botswana aspires to offer quality education that prepares students to effectively function in today's world of work that requires high order skills. Interactivity, communication and collaboration are some of the crucial elements in building this kind of education. Historically, the education system in Botswana, like in many other African countries, was inherently autocratic with little to no contribution by students to the creation of knowledge in the learning process (Jonas, 1994; Mololwane, 1993). The use of the 21st century technology resources brings optimism that such use can change the landscape to a more participatory one. SMART technologies were also reported to provide access to many other learning material resources, thus enabling students to search for information themselves, thereby giving them something to contribute to their learning and also empowering them to realize that they can play an important role in the formation of new knowledge. In accordance with the theoretical underpinnings of this study, these reported effects of the SMART technologies on students' learning suggest a successful implementation of the project as per the set objectives.

From this study, one of the reported benefits of the SMART technologies was the ability to motivate students. Participants expressed high levels of motivation and excitement when using SMART boards in their lessons. This was evidenced by the use of words such as "fun", "exciting" "intriguing" in describing how they felt when the tools were used. Also in the study, correlation results between motivation and engagement indicated an increased level of engagement when students were motivated. Motivation is an intrinsic force that plays a crucial role in people's willingness to carry out an activity or pursue a goal. According to various technology adoption frameworks, motivation is an important antecedent of effective and sustained technology use. As such, it is a critical input in the success of a project. Numerous other studies have reported an increase in students' motivation when technology is used (Means, 1993; Granito & Chernobilsky, 2012; Daniels, 2004; Vanwelsenaers, 2012). This implies that efforts to promote students' interest in learning should highly consider technology use in the delivery of education.

Furthermore, students in this study reported that the use of the SMART boards improved their learning achievements. However, these findings were self-reports by the students, which need to be backed by valid statistical measurements to improve confidence in such claims. This study did not seek to do a statistical measure of students' achievement. Nevertheless, these beliefs by students on the positive influence of technology on their learning achievement are a powerful precursor in promoting positive academic performance. The Unified Theory of Acceptance and Use of Technology (UTAUT) model posits that when people believe that the use of a particular resource improves their performance then they will be more disposed to use it (Venkatesh, Morris, Davis & Davis, 2003). In this case, the students' belief that the SMART boards improved their achievements is an overt stimulant that can inspire them to work harder and perform well.

CONCLUSION

Overall, the results of this study showed that students perceived the use of the SMART boards to have a positive impact on their learning. The study indicated that the use of the SMART boards addressed the three domains of learning: cognitive, affective, psychomotor, as articulated by Bloom (1956). Bloom's taxonomy is a key tool in structuring and understanding the learning process. It implores educators to cover a whole spectrum of learning activities that address low to high order skills. The SMART boards enabled learning experiences that assisted students in ascending levels of thinking within the various domains. This is very significant for an education system such as the one in Botswana, which is struggling to break away from traditional forms of learning that are characterized by direct instruction, rote memorization and limited students' participation. With the advent of technologies in learning, Anderson and Krathwohl (2001) have proposed a revised version of Bloom's taxonomy, coined 'Bloom's Digital Taxonomy', which tries to account for the new behaviors and capabilities that emerge as a result of technology advances. In this study, these were demonstrated as students performed various digital activities such as editing, labelling, annotating, collaborating and simulating. Equipping children with such skills is a prudent step in building a human resource that can propel the country to a knowledge-based status to which it aspires.

The ultimate goal of the Government of Botswana is to provide its children with quality education that matches the best global standards of the 21st Century. It is clear from the feedback provided by students in this study that SMART boards are a powerful tool in the hands of students and teachers to bring the required changes to learning environments. As such, a wider use of these tools is highly recommended in the endeavor to revolutionize the education system. The results of this project provide valuable feedback from critical stakeholders in the education system, which should be used as a basis for improvement in moving forward technology integration and the overall strengthening of the quality of education in the country.

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