FACTORS AFFECTING THE INTEGRATION OF INFORMATION AND COMMUNICATIONS TECHNOLOGY IN TEACHING AND LEARNING IN SENIOR SECONDARY SCHOOLS IN BOTSWANA

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Abstract

Botswana Education and Training Strategic Sector Plan outlines government intentions to integrate Information and Communications Technology (ICT) in school management, teaching and learning to help the country become a globally competitive knowledge and information society. However, research has established that integration of Information and Communication Technologies in teaching and learning is wrought with challenges. To date, no study has investigated teachers' perceptions on how school characteristics, adequacy of materials and change management strategies affect integration of ICT in teaching and learning in Botswana, a gap this study fills. This multi-site interpretivist study applied the Tearle Theory as an analytical framework. The research data was obtained through semi structured interviews with teachers' in government senior secondary schools. The findings of the study highlight the need for all stakeholders in ICT integration in teaching and learning in Botswana to play their role for successful integration of ICTs in teaching and learning. It is hoped that the findings of the study will shed insights into the implementation dynamics that affect implementation outcomes in ICTs in Botswana schools and similar contexts elsewhere.

Keywords: ICT integration in education, Botswana, Botswana Education and Training Strategic Sector Plan, Vision 2036

1.0 Background

The Government of Botswana has since 1994 outlined strategies to create a conducive environment for the integration of Information and Communications Technology (ICT) in teaching and learning across all levels of education. These aspirations have been expressed in the 1994 Revised National Policy on Education and the National Information and Communications Technology Policy of 2007 which contains a section on Thuto-Net. Thuto-Net articulates how integration of ICT in teaching and learning must be done and the rationale (Botswana Government, 2007). Amongst other things, the policy document outlines why it is necessary to provide students with access to classroom computers and appropriate computer to student ratio for adoption at all levels of the educational system (Botswana Government, 2007). The policy document also states why and how teachers, school heads, school IT managers and teachers ought to be trained (Botswana Government, 2007).

The Botswana Education and Training Strategic Sector Plan 2015-2020 (ETSSP) (Botswana Government, 2015) echoes these goals as it states that in order to create a conducive environment for use of ICT for teaching, learning and school management, the government will "provide schools with high speed internet access, design and develop e-content and implement the content and curriculum for primary, secondary, vocational and tertiary schools with e-learning established as a standard learning methodology" (Botswana Government, 2015, p. 114). It is anticipated that this will create an education and training system where teachers and school management teams confidently utilize ICTs for teaching and administrative purposes and entrench e-learning as a standard learning methodology. By 2036, the country envisions that the education system would be producing human capital that is relevant and globally competitive (Botswana Government, 2016). It is anticipated that adoption of ICTs for teaching and learning will effectively prepare learners for the world of work and industry as the use of ICTs for teaching and learning is said to enhance reasoning, problem solving, creative thinking and comprehension skills (Mikre, 2011). Vision 2036 further states that by 2036 "Botswana society will be knowledgeable with relevant quality education that is outcome based" (Botswana Government, 2016, p. 20). This assertion is not remiss as using ICT for teaching and learning is said to be instrumental in shifting the focus of teaching and learning to a student-centred approach (Wang & Woo, 2007; Sife et al., 2007). Other documents which address ICT integration in teaching and learning include the National Human Resource Development Strategy of 2009 (NHRDS), National Development Plan 11 (NDP), the Botswana Education and Training Strategic Sector Plan (ETSSP 2015-2020) and Maitlamo.

These intentions and desired outcomes are drawn from widely held beliefs about the benefits of ICT use in teaching and learning that, when used for curriculum delivery, ICTs enable students from diverse economic status, physical ability and geographic distance to access top notch information or teaching, thus promoting equality (Tearle, 2003; Waycott et al., 2010).

1.1 Problem statement

While these goals and intentions are admirable and the expectations are feasible, research has established that integration of ICTs in teaching and learning is wrought with challenges, as failure of ICT initiatives in education is a persistent concern reflected in research (Alkahtani, 2017; Karasavvidis & Kollias, 2017; Mwapwele, Marais & Dlamini, 2019). Furthermore, in 2011, the Independent Evaluation Group of the World Bank established that 70% of the World Bank ICT4D projects failed to achieve their goals (World Bank, 2011). Failure of ICT initiatives in education can be categorized as process, interaction, expectation and contextual failures (Pelgrum, 2001).

Research has also established that teachers use ICTs to transmit subject content rather than use it to enhance learning. To mitigate, Buabeng-Andoh (2012) argues that teachers should be trained not just on basic computer skills but on the impact of ICT on pedagogy as teachers' technology skills are not the only condition for effective use of technology in the classroom.

Furthermore, teachers' understanding on how to apply technology to support students' learning and attainment has been found to increase teachers' knowledge level, confidence and attitudes towards technology (Nyambane & Nzuki, 2014).Other studies have attributed failure to integrate ICTs in teaching and learning to technophobia and age-related adoption issues as older teachers have been found to struggle to adopt ICT for teaching and learning. Other studies attribute the failure to school leaders' lack of interest in the implementation process as they fail to provide guidelines that compel teachers to integrate ICT for teaching and learning. Problems with infrastructure such as limited access to the Internet, ICT equipment security issues, the high costs of acquiring and setting up ICT-based Management Information Systems are also said to contribute to the failure to integrate ICTs in teaching and learning (Banda, 2016; Buabeng-Andoh, 2012; Ford & Botha, 2010; Gilakjani, Leong & Ismail, 2013; Siphiwosami, Mamba & Isabirye, 2015).

Although the Thuto-Net document articulates mitigation of some of these factors by mentioning how ICT integration in teaching and learning ought to be addressed, there is a dearth of information on teachers' perceptions about the success of the implementation of Thuto-Net and factors that affect integration of ICT in teaching and learning in senior secondary schools in Botswana. Studies done in the area of integration of ICT in teaching and learning in schools in Botswana include Garegae and Moalosi (2011) and Nkhwalume (2013) who investigated the challenges teachers encounter when they try to integrate ICTs in Botswana Mathematics Curriculum. Mafuraga and Moremi (2017) discuss how ICT could be integrated in the teaching of English Language in Botswana junior secondary schools. Kgalemang et al. (2015) looked at challenges that hinder the use of technology to support teaching in junior secondary schools while Leteane (2015) investigated usage of ICT by primary school teachers in Gaborone. Hamaluba (2019) investigated computer and ICT skills of Business subject's learners at Botswana Open University (BOU).

It is imperative that studies unpack the interaction processes between ICT and the social-cultural, organizational, economic factors and context-dependent power structures and their bearing on the failure and successes of such projects from the teachers' perspective (Mooketsi & Chigona, 2016; Zheng & Walsham, 2008; Walsham & Sahay, 2006). To fill this gap, this study investigated teachers' perceptions on how school characteristics, availability of materials and change management strategies affect integration of ICT in teaching and learning in senior secondary schools in Botswana. This is important as the education and training reforms make it imperative that organizations, practitioners and stakeholders examine priorities and milestones to be achieved and draw up strategies to map how these are aligned to function cohesively to achieve the required transformation.

1.2 Research questions and organization of the paper

The study was guided by the following research questions:

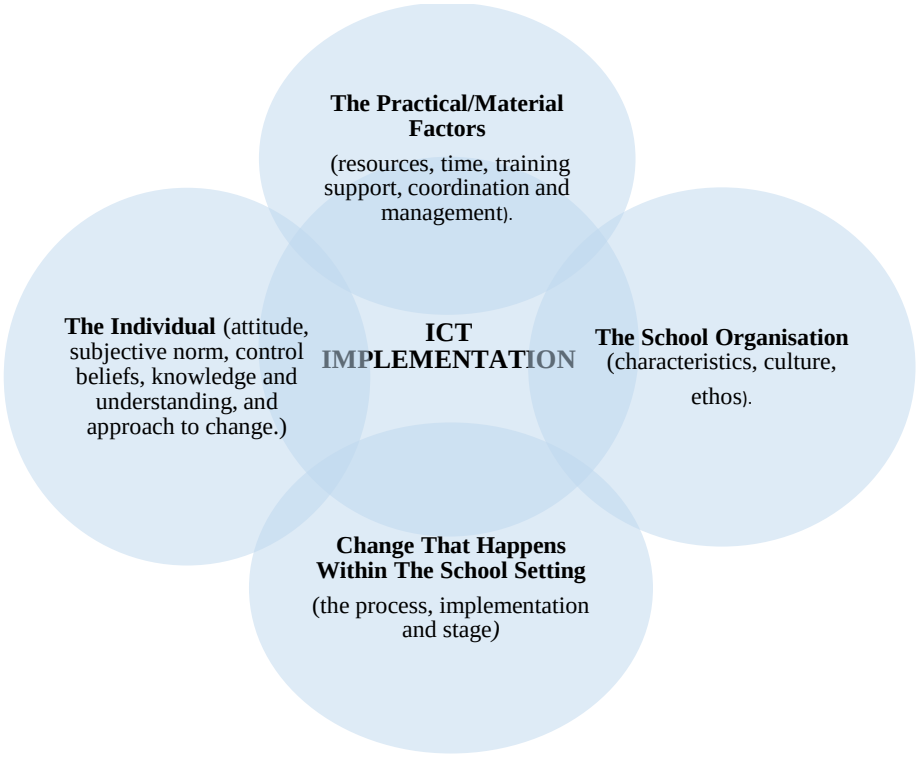
a) What are the perceptions of teachers on the adequacy of facilities and resources to achieve effective and sustained utilization of ICTs in teaching and learning?
b) What are the potential barriers to ICT use for teaching and learning?
c) What school-based policies and implementation strategies exist in schools for promoting the use of ICTs in teaching and learning?

2.0 Theoretical framework

There are several theoretical frameworks that have been used to study adoption and integration of ICT integration in teaching and learning. Amongst these are Theory of Reasoned Action, Technology Acceptance Model, the Technology Organisation Environment, the Theory of Planned Behaviour and the Unified Theory of Acceptance and Use of Technology. However, given that the study sought to assess how the implementation context, interactions between the policy actors and their social realities affected the adoption process and outcomes, Tearle theoretical framework was selected as it was more aligned to the objectives of the study (Tearle, 2004). The theory has been used in investigation of ICT integration and implementation in teaching and learning by amongst others Tibebu, Banayopadhyay and Negash (2009), Tomei (2010), Luppicini (2010) and Mofarreh (2016).

As indicated in Figure 1, the theory states that there are four interactive factors that have a bearing on the success of integration of ICT for teaching and learning. One of the factors is the individual characteristics of teachers such as their perception on their self-efficacy on the use of ICT for teaching and learning. The other is school organisation characteristics such as the leadership, learning culture, staff ethos, technical support, formal support structures, and collaboration between staff, school culture and morale. Another factor is the material component which involves adequacy of resources, time, training, support and coordination and management of these. The last aspect is the school-based change management strategies to manage the implementation process. To assess school-based change management strategies, the theory states that one must establish if there are operational guidelines to guide both implementers and recipients to ensure understanding and management of the expected changes.

Figure 1: Interactive components that affect ICT implementation in schools



3.0 Methodology

The overarching research paradigm of this multi-site case study is interpretive. The study used a qualitative approach to gather data on teachers' perceptions, as lived experiences, behaviours, as well as the organisational functioning about the factors that affect the integration of ICT in teaching and learning in Botswana with specific focus on the four components outlined by Tearle theoretical framework (Streubert-Speziale & Carpenter, 2007) (cf. Figure 1).

Permission to conduct research was obtained from the office of the President and School Heads in the respective schools. The study sample consisted of 40 randomly selected senior secondary school teachers teaching different subjects in four government senior secondary schools in Botswana, ten from each school. Subject teachers were approached to ask their permission to participate in the study prior to data collection. Research participants were made aware that their participation was voluntary. Research participants were also informed that they could withdraw from the study at any time including during the interview, or request that the data they gave not be used. In addition, it was clarified to participants that taking part in the study posed no harm or threat to them. Participants were also informed that their identity would not be made public. To conceal the identity of the participants, respondents were coded as Teacher 1-School 1 (T1-S1) to Teacher 10-School 4 (T10-S4).

Data analysis was done iteratively consistent with themes derived from the Tearle Theory (Braun & Clarke, 2006). The unit of analysis was segments of texts rather than individual words

or phrases. Meaning comprehension enabled the study to understand the subjective meaning of experiences and situations.

4.0 Findings and discussion

This section discusses teachers' perception on adequacy of resources and time, their self-efficacy and what their colleagues think about the use of ICT for teaching and learning

4.1 Individual teacher characteristics.

4.1.1 *Self efficacy*

There were differences in terms of self-efficacy. Some teachers felt competent to use ICT for teaching and learning whilst some did not feel competent. Feelings of inadequacy were mainly attributed to inadequate or non-existent training on how to use ICT for teaching and learning and for administrative duties. Teachers also reported that they needed training on how to search and access electronic information resources. Teachers who felt they were not competent stated that they were "not trained to use ICT as a teaching tool or had never been trained at all*"* (T1-S1). Similar sentiments were expressed by T3-S4 who reiterated this and stated she was "not competent as I had not done any training."

Teachers who had undergone training felt competent and confident to teach using ICT. They stated that they could make presentations through Power Point and other methods such as projecting pictures. The training ranged from self-sponsored training to Ministry of Basic Education initiated training. The training periods ranged from one day to six months and the training focused on how to use computers and Microsoft Word. One of the teachers stated she trained as "teaching millennial learners helped me to do more research and equip myself further on using ICT" (T1-S3).

This study therefore concludes that there were differences in terms of teachers' skills in capacity use ICTs for teaching and learning in and across schools necessitating the need for training. The need to equip teachers with pedagogical and technological competencies to enable them to integrate ICTs for teaching and learning is also stated by Mbwana (2011) and Kennah (2016).

4.1.2 *Perception on the importance of ICT in teaching and learning*

All teachers stated that it was crucial for them to use ICT for teaching and learning in order to be effective teachers. They stated that using ICT for teaching and learning is crucial as it enables them to "carry out research to enhance our knowledge" (T4-S1) as it is "easier to access information for presentations and demonstrations" (T9-S1). They stated that using ICT for teaching and learning is a modern way of teaching which "makes our jobs easier and faster" (T9-S1) and "is in line with current affairs" (T3-S1). Teachers stated that it was important to use ICT for teaching and learning as "we live in a changing world so learners should be equipped to fit in

and adjust well in developing and developed countries" (T5-S3). They also stated that the "the fourth industrial revolution requires mathematics in the digital world and as such must keep abreast with it" (T5-S1).

Teachers stated that the use of ICT in teaching and learning improves teaching and learning as it is different from the norm, is more interactive and engages more senses which makes learning relatively simpler and helps students to remember. They also stated that students easily access information, which promotes learner centeredness and independent learning as "learners do not depend only on the information from facilitators; they can also find it for themselves" *(*T10-S4). Teacher T5-S2 stated that "the use of audio-visual helps do away with the monotony of lecture method where the teacher is always in the forefront." In Mathematics teaching and learning, Teacher T8-S2 reported that "it makes Mathematics entertaining both to the teacher and learner." They stated that it is important to use ICT for teaching and learning because learners are "21st century learners who are more into gadgets and can excel very well using them" making it "very crucial as our learners are digital" *(*T7-S4). They stated that using ICT in teaching and learning helps with the transition from paper to digital and "if the school can be equipped with tablets connected to the internet, learning will be effective especially in school libraries for students to research and find new books rather than purchasing expensive books" *(*T1-S1).

4.1.3 *Subjective norms*

Teachers stated that some of their colleagues felt that the use of ICTs in teaching and learning "is too modern and complicated for their liking" (T1-S1). However, most reported that their colleagues felt that use of "ICTs in teaching and learning is important and must be implemented in schools across all subjects" *(*T5-S4). They stated their peers agreed "on use of ICT and feel lack of internet or ICT hinders their creativity" (T6-S2). Most teachers reportedly "want to learn but find it impossible as there are no resources" and "they are positive about it; the issue is unavailability of the needed resources" (T1-S4).

4.1.4 *Factors motivating integration of ICT in teaching and learning*

Teachers stated that they were motivated to integrate ICT in teaching and learning because it enables them to keep abreast with technological changes, makes teaching and learning easier, reduces dependence on textbooks and makes handling mixed ability classes easier. Even though the use of ICT in teaching and learning is mandated by policy, job expectation was not a motivating factor. This is probably because teachers reported that they have not read Thuto-Net or Education and Training Sector Strategic Plan (ETSSP). They stated that their participation in the use of ICT in teaching was because of some workshops on ICT implementation that they had attended or were briefed on in staff meeting. Buabeng-Andoh (2012), Cubukcuoglu (2013) and Vodopivec and Bagon (2016) also established that intrinsic factors rather than policy motivated teachers to use ICTs for teaching and learning.

4.1.5 *Teachers expectations regarding student's integration of ICT in learning*

All teachers stated that they expected students to be able to use Microsoft Word to type and print assignments, make illustrations and graphical presentations and use the Internet to search for subject content. Teachers stated that their role as teachers in ICT integration is to encourage learners to use ICTs, teach students how to use ICTs, assist students with the use of ICTs, and teach using ICTs.

The study therefore concludes that teachers are motivated to use ICT in teaching and learning and teach students how to use ICTs. Teachers appreciate the importance and benefits of using ICT for teaching and learning. Teachers acknowledge that it is crucial for them to use ICT for teaching and learning to be effective teachers. Furthermore, their colleagues are also in support of adoption of ICT in teaching and learning. Subjective norm is important as approval of a behaviour by one's peers predisposes one to perform the behaviour. Similarly, Ouma et al. (2013) and Tedla (2012) established that teacher's awareness of the potential of ICT in teaching and learning leads to effective use of ICTs in the educational situation. Ngeze (2017) and Pima (2019) also established that teachers in Tanzania were willing to use ICT in their teaching and learning activities as they were aware of the benefits of using ICTs in teaching and learning.

4.2 School organisation characteristics

4.2.1 *Availability of time to teach students how to use ICTs for learning*

Teachers did not feel that the demands of their work environment stopped them or constrained them from teaching students how to use ICTs for learning. They stated that "time is available" but they were constrained as "there are limited computers, computers were only in the computer laboratory yet few" *(*T1-S4). They stated, "teaching students how to use ICT requires ICT equipment which are not at our disposal" *(*T9-S3).

4.2.2 *Challenges*

Teachers reported that they experienced several challenges when it comes to the integration of ICT in teaching and learning. They cited lack of change management strategies as they reported that using ICT for teaching and learning "requires learning new skills and it is not easy to change from old methods to new ones" *(*T1-S2). They also stated that inadequate training in the use of ICT for teaching and learning was also one of the key challenges. Teachers felt they should be trained to use ICT platforms for teaching and learning to assist them to incorporate ICT for teaching and learning. They also emphasized the need for workshops for learners.

With respect to availability of ICT resources for research, teaching and learning, there were variations across schools. In some schools, staff had access to computers in the library and staff room and subject departments as "every department has a computer free to use though there is internet limitation" (T1-S2) whilst some teachers reported that their schools did not have enough ICTs available for successful use of ICT for teaching, learning and administration. Similarly,

students did not have access to computers outside lessons as teacher T3-S3 stated "learners currently do not have access, it is only the teachers." Almost all schools had access to the Internet although access was not regular.

To mitigate the challenge of inadequate resources, teachers proposed that schools should focus on infrastructure provision and "get equipment as we have empty computer labs"*(*T1-S4), and that schools be provided with electronic gadgets such as projectors, interactive boards and internet services. They proposed that "at least each department must be given a laptop since some teachers are workshopped and cannot practice what they have been taught due to lack of the aforementioned" (T9-S1). They expressed that with all the resources and infrastructure in place, incorporating ICT for teaching and learning will not be a challenge "as it is effective and efficient, people just need to be workshopped in it" (T1-S1). They also stated that schools should place "more emphasis on the importance of ICT in all departments" *(*T1-S3).

4.2.3 *Adequacy of support to integrate ICT's in teaching and learning*

Teachers felt that they did not have enough support when it comes to the integration of ICTs for teaching and learning. They stated that the main challenges they encountered were lack of technical support and inadequate acquisition of resources to replace those being written off. They also stated that there was inadequate maintenance of malfunctioning resources. They stated that maintenance of school ICT resources was done by the ICT department, computer programmer, computer studies teachers, the librarian and library attendants who also controlled access to the resources. They rated the responsiveness of these officers to requests for maintenance and support as average as they stated the officers were "trying where they can" *(*T9-S4) and "they try their best" *(*T1-S3). In one school, teachers stated that there was only "one officer available so if not available then there is no help at all" (T1-S4).They stated that failure to maintain available ICTs might lead to complete damage of the computers resulting in no ICT usage at the institution which will affect students.

The study concludes that according to teachers, facilities and resources are not adequate to achieve effective and sustained utilization of ICTs in teaching and learning. Similarly, Dlamini and Mbatha (2018) in South Africa and Turugare and Rudhumbu (2020) in Lesotho established that ICT integration for teaching and learning was constrained by limited financial resources resulting in inability to invest in new technology and uncoordinated staff development approaches to technology integration. Edokpolor (2019) and Mavellas, Wellington and Samuel (2016) also established that inadequate facilities hampered utilization of ICT in teaching and learning. Similarly, Mafang'ha (2016) and Ngeze (2017) established that although teachers were aware of the benefits of using ICT to facilitate teaching and learning and were willing to use ICTs, they are failed by the system which hampers effective utilization and integration ICT for teaching and learning. Teachers need to be trained to have the skills and knowledge to use ICT in teaching and

learning. Similarly, Buabeng-Andoh (2012) established that a teacher's use of ICT was still confined to basic and traditional activities such as search for information and class presentation.

4.2.4 *Coordination of policy adoption activities in schools*

This section reports on teachers' perceptions on school based operational guidelines to ensure understanding and management of the expected changes. None of the schools conducted skills audit to establish teachers' ICT competencies or used school-based in-service training to address teachers' ICT skills. Furthermore, no school has school-based strategies in place to guide and ensure that teachers align their daily activities and key activities to the intentions of the ETSSP and Thuto-Net. Teachers felt that school administrators and school management teams were not competent in the use of the technology or conversant with the technical, pedagogical, administrative, financial, and social dimensions of ICT use in education.

Teachers stated that they expected the school management teams in their schools to develop and implement ICT training for both students and teachers**.** They also stated that school management teams needed to facilitate the use of ICT for teaching and learning by acquiring and providing required resources and ensuring adherence by monitoring. Most importantly, they expected management teams to provide strategic direction and leadership to ensure seamless coordination of activities and coherence of efforts. Teachers stated that they expected the Ministry of Basic Education to provide relevant ICT resources for each subject, software, and computers with internet access to ensure that these were available for teachers to use any time. They stated that ensuring daily access will help "as at times teachers are trained and become rusty due to lack of practice" (T9-S4). Teachers also stated that "the ministry should provide ICT people who are specifically meant to teach both staff and students for a certain amount of time" (T1-S2).

The study concludes that despite the dictates of policy, no senior secondary school has school-based policies and implementation strategies to promote the use of ICTs in teaching and learning. Similarly, Mofarreh (2016) established that implementation of ICT policies in secondary schools was hindered by lack of ICT policy planning and development processes, and lack of leadership coordination and management.

School Management Teams must manage the integration process by setting up school-based programs and interventions to sensitise teachers on policies. School Management Teams need to be capacitated to manage integration of ICTs in teaching and learning and the change process. There is also need for performance management and monitoring to ensure adherence and enhance performance (Chowdhury & Shil, 2019). School leadership is vital in educational reform and change (Datnow & Park, 2019; Hargreaves & Ainscow, 2015); Harris, Jones & Huffman, 2017; Harris & Jones, 2019).

5.0 Conclusion

This study primarily sought to investigate teachers' perceptions on how school characteristics, availability of ICT resources and change management strategies affect integration of ICT in senior secondary schools in Botswana. This study established that teachers understand the value of ICT integration in teaching and learning and are willing to teach using ICT and teach students how to learn using ICT. However, there are still challenges due to inadequate resources, insufficient technical support, inadequate support from administrators and lack of change management strategies. The findings show that it is imperative for all stakeholders such as schools management teams and other stakeholders to examine priorities and milestones to be achieved and establish how these are aligned to function cohesively to achieve the required transformation.

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