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Examining the Learner-Teacher Digital Divide: Implications for Learning in Basic Education Classes - Insights from Teachers in Botswana

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The world has witnessed a technological revolution that has impacted almost all spheres of life. Technology is transforming the way people interact and do their everyday activities. This technological revolution has also transformed the teaching and learning space; now, the effectiveness of traditional teaching method is being challenged. However, technological advances are not universally available leading to a phenomenon called digital divided. In the classroom, empirical evidence has revealed a discrepancy between teachers and learners concerning ownership and use of technological devices. In some cases, teachers have more computer skills than learners; in other cases, learners are embracing technology more than their teachers. This disparity may serve to inhibit rather than facilitate learning. The constructivist paradigm was applied to enhance the dependability of the data and the credibility of the inferences drawn from the data. Purposive sampling technique facilitated select of information-rich participants or teachers who were able to give a detailed account of the digital gap phenomenon in schools. Structured

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interviews and focus group sessions were used to capture the livid experiences and perspectives of the teachers. Diffusion of innovation theory, technological acceptance model and technological pedagogical content knowledge framework were also used to explain the level of technology acceptance in schools. The findings of the study pointed towards the existence of the digital divide with learners embracing technology much faster than the teachers. Younger teachers were reported to be interested in the use of technology more than long-serving teachers. The paper presents solutions aimed at reducing the digital gap.

Keywords: Digital divide; diffusion of innovation; critical thinking; self-directed learning; technological pedagogical content knowledge; constructivist paradigm.

1. INTRODUCTION

Delivery of instruction within the learning and teaching process has always assumed a flow of information from the teacher to the learner [1]. The teacher in a traditional setup is the one who possesses superior knowledge about the subject matter of interest. According to Huang et al. [2]; "Traditional instruction emphasized a teacher-dominated, test-oriented, and mechanistic approach that provided little opportunities for developing student critical thinking skills" (p. 33). However, the emergence of information and communication technology (ICT) is currently having a disruptive effect on the relationship between the teacher and the learner. Learning is now a twenty-four hour engagement. Whether the teacher is available or not, learning can continue at a place and time decided by the learner [3]. This emerging situation calls for the educational landscape to be deconstructed and re-constructed to "suit the technological environment that continues to grow in an unprecedented way" [4], (p. 33).

2. BACKGROUND

Researchers in the educational field have long had a strong conviction that technological affordances have the potential to help learners develop high-order thinking skills such as problem solving and critical thinking [5-7]. Therefore, first generation of technology integration models had an underlying assumption that once the hardware and software were widely available in schools, the learning and teaching process will also be transformed [8,9]. This assumption turned out to be an over simplification of a complex implementation process [10]. The disconnect between policy aspirations and actual implementation of the policy recommendations has been summarized well by Tobin et al. [11] when they stated that "The evidence suggests that, despite these widespread calls for reform, traditional practices have been remarkably robust and resilient to the forces for change." (p. 224). Studies conducted in different countries using different research designs have shown that teachers have largely stuck to traditional methods of teaching even in situations where there was adequate supply of computers [12,10,13].

Initially, digital divide was defined as the difference between people who possessed electronic devices such as computers and those who had no access to such communication gadgets [14-17]. However, as computers became widely available in society, the digital divide problem was defined in terms of ICT competencies and skills [18]. One of the definitions of the digital divide "… focuses on the consequences of the divide or the beneficial outcomes of internet use." (18, p. 2). For example, [19] has observed that the digital divide can be conceptualized as the degree to which an individual uses the technology to create content. The definition and conceptualization of digital divide continues to evolve as new technologies are invented [15] identified at least 216 different ways of defining digital divide and further posited that:

> … it is neither theoretically feasible, nor empirically justifiable to aim for one single definition of the digital divide. The digital divide is best defined in terms of a desired impact. Since those are diverse, so are the definitions of the challenge. The best that can be done is to come up with a comprehensive theoretical framework that allows for the systematic classification of different definitions. (p. 715).

Therefore, the socio-economic environment prevailing in each country will determine the manner in which ICT is integrated in schools and as a consequence, the presence and nature if the digital divide. For example, several studies in USA have established a digital divide between

urban and rural areas, males and females, high and low income families as well as between racial groups. Mossberger et al. [20] found that African Americans and Latinos were likely to have lower rates of access due to residential segregation and "concentrated poverty" (p. 611). A study by Rafalow et al. [21] was able to demonstrate that the digital divide in schools was not just related to the availability of ICT tools but was also engendered by enduring attitudes and believes of teachers. The study compared the use of interactive whiteboards in schools that differed by socioeconomic levels. The researcher discovered that teachers in high socioeconomic schools used the technology to engage learners whiles those in low socioeconomic schools "used the interactive whiteboard as if it were a simple blackboard" [21], (p. 87). In South Africa, emerging literature points to a systemic digital divide by gender, population groups and educational levels [14]. According to Singh et al. [16], "The main reason for the digital divide in South Africa is the apartheid legacy that promoted separate development, which provided inferior education and poor or no access to learning opportunities for non-whites" (p. 6).

2.1 The Situation in Botswana

The pedagogical practices of teachers in a given country may serve as a catalyst for ICT integration or the behaviour of the teachers can act as a barrier towards technology adoption and use in schools. Several elements have shaped the pedagogical practices of teachers in Botswana. When Botswana attained independence in 1966, conditions on the ground were such that the country had very few primary schools, low enrolment rates and a sizable portion of the teachers were untrained [22]. To solve the problem, the government engaged in rapid expansion of the primary school sector in order "…to increase educational opportunities, and to reduce inequalities of educational opportunities." Printer et al. [23], (p. 99). As the number of schools and enrolments rates increased over the years, the demand for teachers also skyrocketed. The total number of teachers increased from 3.921 in 1976 to 9.772 in 1993, representing a growth of just over 40%. To meet the demand for trained personnel in schools, prospective teachers had to enrol for a two-year training programme which culminated with the award of a Primary Teachers Certificate [24]. Upon graduation, the new teachers were expected to teach all subjects in the curriculum [25]. This policy position was to some extent successful as the number of untrained teachers was gradually reduced. However, the two-year training period was criticized for producing half-baked professionals as indicated in the quotation below.

> The two-year training period further produces an under-trained teacher as it does not afford enough time for the trainee to acquire the necessary knowledge and skills to make an effective and confident teacher... the products of this programme are often dependent on instructional materials and are so insecure that their capacity to be innovative and creative is seriously limited. (p. 345).

Therefore, practicing teachers in schools lacked subject matter expertise and were required to operate has generalists [25]. These two elements created an instructional environment that cannot be regarded as ideal for ICT infusion. Though a three-year diploma programme was introduced in 1993; the generalists approach was maintained and is still being practiced in primary schools. For technology to be integrated in the learning and teaching process, teachers should have relevant ICT skills and ample time to experiment with the new tools.

Several researchers have focused attention on the digital divide problem in Botswana [26-29]. The objective of Oladokun et al. [28] study was to assess the digital divide amongst distance education students located in urban areas and those located in rural areas. The sample of the study comprised 519 participants drawn from a parent population of 1996 tertiary level students. The results of the survey indicated that 78% of learners staying in urban centres had access to computers with internet connectivity. In contrast, only 21.2% of students living in rural areas had access to the internet. Existence of the digital divide was also found by Mpofu et al. [27]. The study sought to determine the influence of previous exposure to ICT on the performance of first-year students studying for an accountancy degree. It was established that learners who studied ICT at secondary school level outperformed their counterparts with no previous exposure. More evidence in support of a digital divide amongst students in tertiary institutions was provided by Kgosiemang et al. [26]. The purpose of the study was to determine whether University of Botswana full-time and part-time students (i.e., those studying for a Diploma in Accounting and Business Studies or DABS) were

given the same amount of ICT training hours. The analysis showed that DABS students were receiving limited ICT contact hours as compared to full-time students. Therefore, empirical evidence provided by studies in Botswana point towards the existence of a digital divide in educational institutions. However, most of the studies investigated the digital divide problem at tertiary institutions. The current study investigated the digital gap between teachers and their learners in basic education classrooms.

3. THEORETICAL FRAMEWORK

It is almost impossible to find a single theoretical framework that perfectly explains the phenomena understudy. Usually, several theories are relevant as they address the problem from different angles. In the current study, three theories have been found to be relevant and these are the diffusion of innovation theory (DIT) [30,31], technology acceptance model (TAM) [32-35] and technological pedagogical content knowledge framework [36].

Diffusion of innovation theory - According to DIT, people use technological innovations at different rates as a function of their personal characteristics. Within the school setting, the theory can be used to categorize teachers according to their innovativeness level. The first group of teachers to embrace technology are characterised as early adopters. These will be teachers who are willing to invest a considerable amount of their time and resource in acquiring and using ICT resources. Teachers who show some degree of determination to learn and apply ICT but their commitment and passion is not at the level of the early adopters are identified as early majority. The third group of teachers to embrace ICT belong to the late majority category. The late majority comprise of teachers who are resistant to new technology as they prefer to see positive results associated with the new technology before they decide to join the bandwagon. The last group of teachers to embrace technological innovation fall under the category of laggards. This group is made up of teachers who have been in the system for a long time making them to be highly resistant to new ideas that might change the status quo. One important lesson from DIT is to avoid treating teachers as a homogeneous group; each category requires a specific intervention strategy aligned with their level of ICT readiness. Strategies put in place to assist teachers characterized as laggards will have to be markedly different from incentives provided to early adopters in recognition of their commitment

Technology acceptance model - TAM was originally developed by Davis et al. [32] but was later modified by several scholars such as [33]. The two core variables in all of the TAM models are perceived usefulness and perceived ease of use. According to Davis et al. [32]:

> Perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance." Perceived ease of use is defined as "the degree to which an individual believes that using a particular system would be free of physical and mental effort." (p. 32)

Teachers expect an ICT device to immediately boost their performance levels; this can only happen if the affordances of the technology are well matched with the teacher's daily work specifications and the technology can be mastered in a relatively short period of time. A technology that has a wide range of uses but is difficult to learn will receive less support from the teachers compared to an ICT tool that may have less features but is not only relatively easy to learn but enhances productivity. Therefore, the reasons behind rejection of a technological artefact in schools might have more to do with the features of the technology.

Technological pedagogical content knowledge – All teachers possesses knowledge of the subject matter and skills necessary for delivering the content to learners. Teacher development programmes have sometimes been criticized for emphasizing one knowledge domain over the other [34-36]. This imbalance prompted [35] to propose a theory that will assist teacher trainers and the teachers themselves to merge the two knowledge domain. Therefore, pedagogical content knowledge (PCK) calls for the infusion of content and pedagogy to help practitioners acquire a new and qualitatively superior form of knowledge. PCT elevates the teachers to a new level of professionalism by allowing them to develop more effective pedagogical methods. Technological pedagogical content knowledge (TPCK) developed by Mishra et al. [34] adds a third element to the two pillars of PCK model. Combination of the three domains of technology, pedagogy and content creates three pairs and one traid [34]. The three pairs of knowledge are content pedagogical knowledge (CPK), content

technological knowledge (CTK) and pedagogical technological knowledge (TP). The technological, pedagogical content knowledge triad (TPCK) lies at the intersection of the three domains. TPCK recognises the fact that ICT functionalities allows for more authentic and more accessible ways of delivering content to students in a manner that can only be characterized as revolutionary. For technology to be successfully intergraded in schools, a determination has to be made as to which combination best suits the teachers in a particular country or locality. If majority of the teachers have acquired PCK status, then proceeding to the TPCK stage will be much easier and wrought with less pitfalls than when teachers are at the content and pedagogy stage (i.e., content and pedagogy are still being treated as separate entities). The different ideas offered by each of the three theories discussed above were applied in the study to understand and explain opinions and perceptions supplied by study participants.

3.1 Conceptual Model

Fig. 1 is an attempt to show how ICT resources have profoundly redefined the relationship between the content, the teacher and the learner. The first point to note is the learner's direct access to the content domain. Direct access also means that the role of the teacher has changed from being regarded as the content authority to a partner in the leaning process. The teacher will still be knowledgeable in a specific area of study but the amount of information available to the learner is far much greater and more current that what the teacher possesses. An obvious advantage of this setup is that learning is no longer constraint by lack of information and physical barriers such as distance or time of the day. However, unrestricted access to tonnes and tonnes of information can be a double edged sword. The learner will have all the information required but the danger of the open access lies in consumption of irrelevant, unverified content or knowledge that has not gone through the rigorous process of scientific falsification [37]. The role of the teacher in this situation is to provide guidance and support to the learner. To orchestrate learning effectively and efficiently, the teacher should be able to infuse technology in the learning environment.

4. STATEMENT OF THE PROBLEM

The apparent disparity of ICT knowledge between the teachers and the learners within basic education classrooms has the potential to impact learning outcomes negatively. The gap has engendered a phenomenon known as the digital divide. While learners are rapidly acquiring ICT skills, some teachers continue to rely on traditional methods of teaching. The consequence of the digital divide is that the teachers, rather than being facilitators of learning, will be an impediment to it.

4.1 Purpose of the Study

The main objective of the study was to find out whether the digital divide was present between learners and their teachers. Once the gap was established, an evaluation of the impact of the digital gap in the classroom was made and appropriate solutions to the negative effects of the divide were sought.

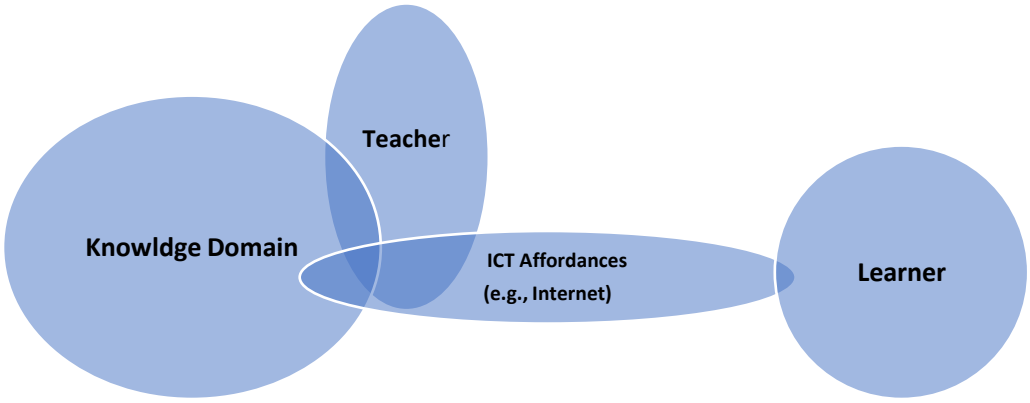

Fig. 1. Reconfigured relationship between content, leaner and teacher

4.2 Research Questions

Sampled teachers were called upon to provide information relevant for answering the following research questions;

1 Is there a digital divide between learners and teachers in the basic education classes?
2. What is the impact of the observed digital divide in the learning and teaching process?
3. How can the digital divide problem be solved?

4.3 Significance of the Study

The study is focused on narrowing the observed digital gap between the learner and the teacher. The assumption is that as the gap is reduced, instructional effectives will increase leading to significant improvement in performance levels.

5. LITERATURE REVIEW

According to Teo et al. [38], "It has been suggested that if teachers believed or perceived proposed computer programs as fulfilling neither their own or their students' needs, they are not likely to attempt to introduce technology into their teaching and learning" (p. 414). Researchers in developed and developing countries have explored the critical role played by teachers in the ICT integration process. According to Barone et al. [39], most of the countries with developed economies have now reached the critical mass stage in provision of ICT to schools and training of teachers. It is however sobering to note that pedagogical philosophies of teachers in some of the countries have resisted influence of ICT. For example, [40] investigated the influence of attitude on ICT integration using data from 1165 pre-primary, primary and secondary schools teachers in Greece. The multiple correspondent analysis technique (CAT) produced three groups of teachers differentiated according to their attitude towards computers. These were "a group of teachers having positive attitudes toward the items of the research, a second group with negative attitudes and a third one with beliefs neutral about ICT in education" (p. 149). Younger teachers in the sample tended to have positive attitude toward use of technology in teaching. Experienced teachers, on the other hand, were sceptical about the impact of technology in the classroom. Their scepticism emanated from a believe system that some teachers develop over time which eventually forms a school culture [41]. More importantly, findings from the study showed "a close relationship between subject matter and teachers' attitudes towards ICT in education" [43], (p. 169). Mathematics teachers were found to be highly conservative and anti-technology as indicated by the following comment tendered by one teacher:

> I do not believe that computers can improve learning. I am totally convinced that calculators have restricted students' achievement in numeracy. In the following years, we will see the same thing happening, e.g. a whole generation of students with low achievement in mathematics. Computers will prevent their development in mathematical thinking [40]. (169)

Cuban et al. [42] studied experiences of teachers and learners of two high schools located in the Silicon Valley, a US neighbourhood known to be a technological innovation hub of the world. The schools were matched according to their socioeconomic and technological integration status. In spite of availability of computer hardware and software in the two schools, teachers used the resources sparingly and stuck to traditional teacher-centred methods whenever a computer was used. To further demonstrate the influence of teacher attitude on acceptance of ICT, [43] used quantitative and qualitative methods to collect data from pre-service and in-service teachers in Netherlands. A general conclusion from the study was that teachers used technology to a limited extent. Complexity and lack of support from school authorities were identified as some of the obstacles to wide-spread acceptance of technology.

The slow uptake of technology in educational institutions has also been confirmed in emerging economies around the world. For example, [44] conducted a study in Turkey to determine the frequency and level of use of Geographic Information Systems (GIS) software in secondary schools. The findings indicated that only 16% of the teachers used GIS for teaching. One contributing factor to low level adoption and use was that majority of teachers were not trained on how to meaningfully integrate GIS technology into the classroom activities [44]. Studies in India also recorded low adoption of technology in schools. Mahajan et al. [45] used data from 100 secondary school teachers in Jawali and Nurpur precincts to assess the level of technological appreciation amongst the teachers. Only 25% of the teachers indicated having a positive attitude toward technology; low application of technology

in teaching was blamed on "technological phobia" (p. 145). The researcher subsequently underlined the "need for teachers to improve their skills through frequent use, and practice, in order for them to successfully use any technology in teaching" (p. 145).

African countries have also joined the technology bandwagon by devoting a large chunk of their budget to the education sector specifically for infrastructure provision and training of teachers and learners [46,47]. Kenya drew inspiration from numerous international policies to put in place a robust policy framework aimed at creating an enabling environment for the emergence and growth of e-learning [48]. The international protocols include World Summit on Information Society (WSIS, 2003) and the New Partnership for African Development (NEPAD, 2012). Within the country, the Government of Kenya introduced the National ICT Policy (2006) which was followed by a host of other legislations. Two quantitative studies situated in two different educational regions of Kenya posted finding that were similar regarding the critical role played by teachers in infusion of ICT in the teaching and learning process. In the first study, [48] formulated a hypothesis that required application of multiple regression techniques to determine whether there was a significant relationship between a variety of teacher characteristics and attitude towards integration of ICT. The study used 140 out of a population of 1364 primary school teachers from Nakuru County in Kenya. The analysis produced significant unstandardized beta coefficients showing that teacher experience, ICT training and qualifications were strong predictors of attitude towards ICT integration. The effects of ICT training and teacher attitude were corroborated by findings from a study done by Mutisya et al. [49]. The evidence generated from the study showed that use of ICT in the classroom by teachers was low. When quizzed on the low ICT acceptance in schools, the Head Teachers who participated in the study mentioned inadequate training and negative attitude of teachers as some of the stumbling blocks.

Following introduction of a new curriculum in 2007; mathematics teachers in Ghana were expected to integrate ICT in their lessons. However, a mixed model study done by Agyei et al. [50] produced evidence indicating that shortage of ICT infrastructure and low levels of ICT use by the teachers were some of the barriers to ICT integration. A similar disconnect between policy aspirations and behaviour of teachers in the classroom was established in South Africa. After obtaining numerical data from 22 secondary school teachers in Limpopo Province, [51] analyzed the data to establish the "effects of Information Communications Technology (ICT) on rural school teachers' ability to perform their teaching duties and the management of other curriculum-related activities" (p. 1096). The researchers found out that teachers were not frequently and effectively employing ICT devices in their lessons due to lack of equipment, inadequate training and low confidence. A similar descriptive design was conducted by Dube et al. [52]. Gauteng East Cluster primary schools were purposively selected due to high availability of ICT resources as 88% of the schools had adequate supply of computers. Despite an almost ubiquitous availability of ICT resources, a substantial number of teachers had "negative perceptions towards the use of ICT in the teaching…" (p. 90). Low computer self-efficacy and lack of training were flagged as two underlying causes of the prevailing negative attitude held by teachers. Most critically, 78% of the respondents were never trained on how to infuse ICT in their lesson plans. Msila et al. [53] applied a different methodological lens to access views and opinions of teachers in Gauteng district in relation to their level of ICT use readiness. Majority of the teachers interviewed expressed lack of willingness and motivation to use ICT in the classroom. One participant in the study summarized the mood of the teachers by positing that: "I am simply waiting for my retirement. I find it difficult to grasp computers now. I will never be competent in these things… I think schools should rather get new teachers for computers; this is only making us more resentful." (p. 1977). The role played by the school principals was also seen as contributing to lack of use of ICT. One school principle in the study was reported to have kept computes under lock and key; this prevented the equipment from falling into the wrong hands but also meant that teachers had limited access to the gadgets. The attitudes of younger teachers in the study conducted by Msila et al. [53] were in-line with what was documented in previous studies (e.g., 40). In comparison to their senior colleagues, younger teachers had higher ICT competency levels and used the digital tools frequently. The desirable disposition exhibited by younger teachers was attributed to pre-service training programmes that included ICT awareness courses.

Empirical evidence from a relatively recent qualitative study in South Africa conducted by Sethosa et al. [54] not only confirmed the challenges experienced by practitioners in schools but also showed that some teachers were beginning to recognise the instructional benefits of e-learning. In the study, perennial problems such as inadequate supply of ICT equipment, lack of skills, lack of commitment from school management cadres and technophobia were noted as significant barriers. Also, technology use amongst older teachers was found to be very low due to continued preference for traditional didactics and a very strong attachment to the lecturer method. This was highlighted by one of the teachers by stating that:

> I hardly use any ICT in my lessons. I have been using the traditional method of teaching for many years. I am used to it and for some time now, the traditional method has worked for me in terms of achieving good results in my subjects (p. 73).

Even though the study established a link between shortage of ICT resources and low ICT infusion in schools, a change in the perception of teachers was also recorded. Teachers who incorporated ICT in their lessons noticed remarkable improvement in the academic performance of their students. The technology allowed the teachers to capture the attention of all learners and tended to increase their motivation to learn Sethosa et al. [54].

In Botswana, the National ICT Policy or Maitlamo was published in 2007 to serve as a driving force behind the envisioned creation of a digitally supported knowledge-based society. Successful integration of ICT in the education sector as stated in the Maitlamo policy required establishment of the Thuto Net project. Thuto Net mandate encompassed provision of internet connectivity to primary schools, junior secondary schools and senior secondary schools in the country. Evaluation of the success of the policy at primary school level was done by Mogwe [55] and Mogwe [56]. Some of the identified barriers were lack of technical skills, lack of administrative support, lack of time and teacher attitude. At the junior secondary level, [57] made some observation to the effect that "teachers understand the benefits of ICT in education, however they are hindered by lots of challenges and negative attitude…" (p. 6). [58] extended the ICT research field to senior secondary schools by interviewing 40 teachers randomly drawn from ten secondary schools. According to the researcher, schools were still encountering "challenges due to inadequate resources, insufficient technical support, inadequate support from administrators and lack of change management strategies" (p. 51). Suffice to mention at this juncture that the body of literature attesting to low ICT use and negative attitude of teachers is only part of complex and multifaceted phenomena. An increasing number of studies are documenting cases where technology has helped teachers to not only improve their content delivery methods but to also reconceptualise the whole process of learning and teaching. It is therefore prudent to present evidence collected by such studies lest a wrong impression is created of a wholesale rejection of technology by teachers in schools.

5.1 Teachers Exhibiting Positive Attitude towards Technology

To test the relation between attitude of teachers and level of computer adaptation and use, [38] administered the Computer Attitude Scale (CAS) to 139 pre-service teachers from the Nanyang Technological University in Singapore. CAS has 21 five-point Likert scale items divided into four subscales (e.g., Affect, Perceived Usefulness, Perceived Control and Behavioural Intentions). Subscale averages for the teachers were all high showing that teachers had positive attitude towards ICT. In Jordan, [59] used information provided by English Language teachers to assess the instructional effectiveness of interactive white boards (IWB). Although teachers indicated that they had no formal training on the use of IWB, usage of the device was high as teachers found the technology to be useful and easy to operate. The added advantage of IWB was that it gave teachers the opportunity to apply constructivist oriented learning and teaching methods. Al-Zaidiyeen et al. [60] also used a sample of secondary school teachers in Jordan to evaluate their attitude towards ICT resources. The teachers obtained a relatively high average score of 63% showing positive attitude towards use of technology. According to Ndibalema et al. [61], the 2007 ICT Policy for Basic Education in Tanzania made provision for procurement of infrastructure, capacity building and promoted use of ICT as a pedagogical tool in schools. The policy was essentially transformative as it required "…adjustments to more learner-centred and interactive teaching methods, thus redefining the

role of the teacher as a facilitator" (pp. 3-4). Evidence from a mixed model research showed that teachers had adopted a favourable attitude toward technology integration [60]. A point of concern in the study was that the high level of ICT appreciation was not accompanied by frequent use in teaching. Compared to the average mean for positive attitude (i.e., 67%), the mean for frequency of use was low (i.e., 31%). Teachers attributed low use of computers to inadequate availability of necessary ICT resources, internet connectivity problems and training. Positive attitude to computers was also documented by Kibirige et al. [62] in South Africa. The researcher used the Attitude towards Computer Technology scale (ACT) to analyse data provided by in-serve teachers from secondary schools in the Limpopo Province. All three subscales of ACT were very high (i.e., Affective domain 96%, Cognitive domain 88% and Behaviour domain 92%) thus confirming positive attitude. Other studies that recorded positive attitude of teachers regarding use of ICT in schools include one done by Alkan [63] in Turkey, Salele [64] in Bangladesh, Davidovitch [65] in Israel and Zulkipli [66] in Malaysia.

The presented literature on positive and negative attitude of teachers towards technology integration in education is by no means exhaustive. However, the general impression derived from the sources is that ICT integration has not fundamentally and irreversibly transformed pedagogy as expected. Even in situation where teachers expressed positive attitudes, systemic limitations and challenges were still being experienced [45,69]. The other dimension that crops up time and again in the literature is about cases where teachers are not comfortable using ICT tools in class due to lack of skills and negative attitude [45,54]. Therefore, the classroom is becoming a place where there is a convergence of two groups with very different attitudes towards ICT. Teachers prefer using the tried and tested traditional methods of teaching that are characterized by rote learning and preparing learners for summative examinations [2]. Leaners, on the other hand, are increasingly opting for modern ICT learning platforms that offer opportunities for collaboration and independent learning [71]. This clash of cultures has created what is generally referred to as digital divide; the digital divide phenomenon has been put under the microscope by different scholars around the world.

5.2 Assessing the Digital Divide between Learners and Teachers

Research studies exist in the literature that attempted to measure the digital divide between teachers and their learners. Saifuddin et al. [67] administered a 41 item questionnaire to 965 students and 185 teachers in Bangladesh. The researcher wanted to access ownership and use of various ICT tools such as computers, use of the internet and handheld devices. The findings indicated that more students used ICT resources than their teachers although the results were not statically significant. Statistically significant results were obtained from a study carried out by Nwokeocha et al. [68]. The purpose of the study was to compare ICT use between students and lecturers in three Nigerian universities. In response to a question that measured interest in ICT use, students scored a mean of 76.122 compared to lecturer total use mean of 53.594. This difference was found to be statistically significant in favour of students thus confirming the presence of the digital gap between lecturers and students. A similar pattern of results was revealed by Grigg et al. [69] in Australia. Grigg et al. [69] applied a quasi-ethnographic multiple case study design allowing for purposeful sampling of eight teachers and 154 students from four subject areas. The two groups completed questionnaires that quantified their ICT competencies in three subscales: namely ICT Skills, ICT Attitude and ICT application. A digital divide was deemed to be present if the subscale mean for the teachers was significantly larger or smaller than the subscale mean for students. Out of the eight groups, the analysis produced three significant results in favour of teachers and four in favour of the students. The researcher summarized the results by stating that: 'As a result, the study found that a digital divide existed in the majority of classes sampled in favour of the students' [68], (p. 72). One notable finding form the study was that in classes where the digital divide was in favour of the teacher, there was meaningful use of ICT.

Findings from three relatively recent research studies conducted in Indonesia, United Kingdom and Nigeria also uncovered a discrepancy in use of ICT artefacts by students and teachers. In Indonesia, a study by Artini et al. [70] revealed a digital divide between teachers and students concerning access and use of technological devices. While teachers had more access to the devices due to their "occupational status and income" [70], (p. 119), students had an upper

hand regarding actual use of the tools. To assess the level of ICT appreciation between teachers and learners in the UK, [71] carried out a multiple case study experiment where mathematics teachers integrated the GeoGebra software into their lessons. At the end of the study, teachers and students presented contrasting opinions about the relevance of ICT in class. The comments from students were largely positive as they indicated that the GeoGebra technology allowed them to develop problem solving and critical thinking skills. The students also realized that they could use the various affordances of the technology to engage in self-directed learning thus reducing their dependence on the teachers. Surprisingly, teachers expressed pessimistic views about the whole ICT integration project. According to them, the ICT integration project was bound to fail due to a number of challenges that included but were not limited to lack of time to experiment with ICT gadgets, lack of continuous ICT training, inadequate technical support and lack of clear vision on ICT integration in schools. A similar discrepancy between the views of teachers and students was confirmed by Modeme et al. [72] in Nigeria. According to the two researchers, music teachers in the sampled schools continued to use traditional methods to teach music while students preferred "technologically based teaching" (p. 130).

In summary, the extant literature appears to be suggesting that some teachers in both developed and developing economies are constrained by a host of challenges in their attempt to achieve a seamless infusion of technology into the classroom. For analytical purposes, the barriers have been divided into two broad categories [10,12]. The first group of challenges address issues concerning provision of infrastructure and training of teachers. Technology integration challenges emanating from attitude and believes of teachers belong to the second category. While first-order challenges can be addressed by providing schools with necessary equipment and training of teachers, dealing with attitudes and beliefs of teachers has proved to be a hard nut to crack. As a result, a digital divide is developing in schools due to the unchanging habits of some teachers and the rapidly changing learning styles of students. In Botswana, digital divide has received attention mostly at the tertiary level. The current study puts the spotlight on the digital divide between learners and teachers in basic education classrooms.

6. METHODOLOGY

According to Dawadi et al. [73]; "A research study is conventionally guided by a research paradigm(s) which refers to researchers' underlying philosophical views concerning the truth and reality in general and the research issue in particular" (p. 25). Broadly speaking, a research study could be situated in the positivist paradigm or the interpretivist/ constructivist paradigm; the two being distinguished by the position of the investigator in relation to ontological and epistemological assumptions. Researchers subscribing to positivism assume a single form of reality and that the study phenomena can be objectively determined using numerical indicators. Social scientists who are informed and guided by the interpretivist orientation adopt a relativist ontology in which participants may have different interpretations of the same phenomena resulting in the occurrence of multiple forms of reality [74]. In the current study, the choice of methodology was determined by nature of the research questions. The constructivist paradigm was considered to be a suitable methodological framework for the study as it provides ample room for capturing multiple perspectives and livid experiences of teachers. Consistent with the interpretivist paradigm, a quasi-ethnographic research design [68] was used to guide the data collection process. One noticeable advantage of the design is that it allowed the researchers to purposively identify information-rich participants able to provide detailed accounts of their experiences accumulated over a long period of time. The population of the study comprised 145 teachers reading for an MA degree in Educational Management at the University of Botswana. A total of 9 teachers were purposefully sampled from the population. Only teachers who taught for more than twenty years were included in the sample. In other words, only information-rich participants were interviewed.

6.1 Instrumentation

Two data collection techniques (structured interviews and focused group sessions) were used in the study. The interview sessions were conducted in a manner that ensured confidentiality and anonymity at all times. The consent form gave a full explanation of the objectives of the study as well as anticipated positive impact of the study on the learning and teaching process. Participants were made aware of the voluntary nature of their participation and

the liberty to leave the study at any time. Permission was sought from the University of Botswana Office of Research and Development (ORD) to have access to the participant. The data was collected over a period of two months, and each interview session lasted for thirty minutes.

7. DATA PRESENTATION

Two teachers (referred to as first respondent and second respondent) participated in the first structured interview. Both teachers noted that in primary schools, the major barrier towards appropriate use of ICT resources was the lack of computers. The situation was made worse by the fact that some schools had no access to electricity. Teachers in primary schools might have the desire to upgrade their skills and competences in ICT application but were frustrated by lack of computers. The first respondent noted that at her school, one teacher even went to the extent of donating his computer to the school so that learners and teachers could learn some basic ICT skills. Both teachers agreed that ICT knowledge in schools was very low and that there was need for urgent in-service training of the teachers. The two teachers stated that learners showed much interest in acquiring ICT skills. The second respondent emphasized this by stating that:

> *Some of the learners came to school already with some basic knowledge of computers which they voluntarily shared with their peers and teachers.*

The most interesting point noted by the two teachers was that within the primary school setting, learners aged around seven years were the ones who were more predisposed to the use of ICT. On the other hand, school heads had a noticeable phobia towards computers. The negative attitude towards computers prevented them from using technology in their everyday school operations. The two responds agreed rather strongly that ICT application in classrooms has the potential to help learners develop critical thinking skills. The second respondent elaborated the point by saying that:

> *ICT enables teachers to give learners assignments that require them to search for answers on the World Wide Web. This has an effect of lessening the dependence learners have on the teachers and at the same time encourages learners to develop research skills.*

The second structured interview session was attended by one teacher (Third respondent). The teacher noted that her school was currently experiencing a serious shortage of computers. For example, the school with a total population of 500 learners had only one computer laboratory. Any teacher interested in using the computers during the lesson had to book the computer laboratory in advance. To make matters worse, the laboratory was also used for workshops and meetings during the week. The teacher further noted that not all teachers embraced ICT applications in teaching. The respondent made a clear distinction between the attitudes of long-serving teachers and attitudes of teachers who were relatively new in the profession. According to the respondent:

> *Long-serving teachers did not trust the new technology. Firstly, the long-serving teachers were of the view that they had developed tried and tested methods of teaching that have consistently provided good outcomes over the years. They saw no reasons as to why they had to change to something new. Secondly, the long-serving teachers were concerned that ICT was tantamount to adding more work to their already overloaded teaching responsibilities.*

As a result, the long-serving teachers preferred to continue using traditional methods of teaching such as lecture method and giving notes to learners. Young teachers on the other hand, had very different attitudes toward ICT application in teaching. The young teachers were very eager to learn new ICT skills and tried by all means to use the skills to enhance their teaching methods. With regards to use of ICT tools by learners, the third respondents made a contribution to the effect that learners from households with ICT tools and those from homes with no ICT gadgets both showed keen interest. In her capacity as a School Head, the respondent had an opportunity to observe lessons where ICT tools were used. It became apparent that learners were highly motivated and engaged in ICT based lessons. This made the respondent to believe that appropriate use of ICT in the classroom will encourage teachers to use learners-centred methods of teaching. Another point raised by the third respondent was that school heads were generally not positively inclined towards technology. However, circumstances often forced school administrators to use technology. For example, the respondent noted during the interview that:

School heads are required to prepare excel reports regularly; soft copies of the reports are then sent to the ministry of education headquarters. This has forced some school administrators to learn excel software.

Two primary school teachers participated in the third structured interview (Fourth respondent and fifth respondent). Evidence provided by the two teachers agreed with themes identifies in the first and second interview sessions. The fourth respondent noted that her school had a computer lab where teachers were supposed to conduct lesson using ICT. However, the lab was hardly used. Eventually, the computers were moved out of the lab to create space for face-to-face lessons. The fifth respondent mentioned one positive development in her school in the form of provision of Wi-Fi connectivity. The following quotation from the respondent shows that not all teachers took advantage of the resource.

Young teachers were the ones who frequently used Wi-Fi to access the internet for research purposes. On the other hand, long-serving teachers did not embrace the new communication technology because there were left with some few years to retire. Therefore, it was a waste of time for them to learn a skill that was not going to benefit them during their retirement life.

The two teachers participating in the third session were in support of the idea that appropriate use of ICT in class could help learners develop critical thinking and problem-solving skills. As a contribution to the discussion, the fifth respondent stated that:

We are developing the 21 Century learners, so we have to empower them with skills of creativity, innovativeness and critical thinking.

Unfortunately, the academic benefits that could be derived from use of ICT tools were being hampered by the low level of computer literacy amongst the teachers and a serious shortage of computers in schools. To conclude the third session, the fourth respondent summarized proceedings by noting that:

Learners in the basic education system are being left behind because teachers are still relying on old methods of teaching. Secondly, teachers and prescribed textbooks are the two most important sources of content for the learners. There is a heavy reliance on textbooks in-spite of the fact that textbooks are in short supply and they have been known in some cases to contain out-dated information. Technology can be used to allow learners to search for information on the internet.

One teacher was involved in the fourth structured interview session. The teacher (sixth respondent), by way of introduction, indicated that she joined the teaching profession at the age of 20 in 1985. In response to a question seeking information on the digital divide between learners and teachers in her school, the teacher stated that:

The only computers available in the school were received via donations. Teachers used the donated computers to give learners practical experiences such as knowing the different parts of a computer, typing their names and writing. However, the computers were not enough for a population of 120 learners and 40 teachers.

The teacher, however, observed that learners were more engaged in ICT use than their teachers. The reason for this disparity was that some learners came to school with basic computing knowledge and were more eager to acquire additional ICT skills. Teachers, on the other hand, were lagging behind even though there were noticeable differences by gender and age. Female teachers were more pre-disposed to the use of technology than males and younger teachers were also more interested in learning ICT applications than older teachers. The two groups (i.e., female teachers and young teachers) demonstrated their interest in the ICT by attending ICT workshops held in their respective schools. The last structured session was attended by one participant (Seventh respondent). In response to the first research question, the respondent stated that a digital gap was apparent between learners and their teachers. To elaborate on the matter, the teacher posited that:

The main reason for the divide was that majority of the teachers in schools were a product of a traditional teacher training and development system that viewed the teacher as the centre of all knowledge. The role of the teacher was to transmit knowledge to the learners. The transmission process was done mostly by the teacher lecturing to learners and writing notes on the board for learners to copy on to their exercise books.

The seventh respondent described learners as people who were exposed to the information and communication technology; they exhibited these competencies by using smartphones to perform a variety of activities in school. As a result, the school environment became a place where two contrasting cultures were converging and clashing. Learners brought smartphones to schools to use them as learning tools while school authorities viewed the phones a potential source of distraction. According to the interviewee, schools responded to the issue by:

> *…enacting policies that prevented learners from bringing their smartphones to schools. Any student caught holding a smartphone had his or her cell phone confiscated by the school authorities.*

The age factor also emerged during the interview as the responded noted that many teachers were relatively old. They had very little knowledge of ICT and were of the opinion that ICT application in the classroom would disrupt the learning and teaching process. Furthermore, the teachers believed that allowing learners to bring ICT devices to schools will give them the opportunity to engage in mischievous acts such as watching movies in class. In terms of how the problem of ICT divide could be solved, the respondent suggested several intervention strategies as indicated below.

> *Firstly, pre-service training of prospective teachers should have ICT modules that are intended to give teacher- trainees practical ICT skills. Secondly, the school policies that are anti-smartphones should be abolished to allow learners to exploit the full potential of the devices in schools. Thirdly, there should be deliberate programmes that are specifically targeting old teachers to making them realise the value of ICT beyond the classroom. Once the teachers realize that the ICT skills have relevance beyond the school, they will change their attitudes and embrace the technology.*

The respondent argued for the use of ICT to promote discovery learning where the teacher operates as a facilitator and the learners are the ones who are searching and generating knowledge. The participant provided the following advice:

> *For the discovery method to work, teachers should be prepared to ask questions that compel learners to search for information on the internet. The teacher then should provide clear guidance on the assignment including breaking down or unpacking the task so that learners can see the different levels of the assignment.*

The bottom line of the teacher's argument was that teachers should be trained on how to generate and structure tasks that promote problem solving and critical thinking skills.

7.1 Focus Group Session

The focus group session comprised three participants who were holding the position of deputy school heads at their respective schools. The focus group participants are referred to as Participant One, Participant Two and Participant Three. Their teaching experience ranged from 25 years to 36 years in the service. The first participant in the focus group made an observation to the effect that her school had a challenge concerning availability of ICT tools. Fortunately, the local Member of Parliament donated some computers to the school and also provided training to the teachers to make sure that they had necessary computing skills. This sentiment was echoed by the second participant; she noted that her school also did not have enough computers. The school went around the problem by liaising with a nearby junior secondary school that had enough computers. The collaboration between the two schools benefitted learners as after some time, most of learners could perform simple tasks on the computer. The second participant also mentioned the issue of smartphones use in schools. The teacher stated that:

Generally, schools do not allow learners to bring cell phones to class because of the prevailing mentality that the learners will use them to watch movies or engage in other disruptive acts.

However, the three educators agreed that the negative attitude towards use of cell phones in schools should change as cell phones are useful learning devices. The only requirement is that teachers should ensure that learners use them appropriately. During the focus group discussions, participant three described a scenario that epitomized the digital gap developing between teachers and learners. According to the participant, one of the teachers in the school;

> *…gave learners a home-work assignment; one question in the assignment required learners to list five different types of cattle breeds. The teacher expected learners to mention the cattle breeds as provided in the textbook. However, one learner only named two breeds from the textbook and three breeds sourced from the internet. Only two of the breeds were marked correct by the teacher. This initiated a debate between the teacher and the learner concerning the other three breeds. Eventually, the learner was awarded marks for the remaining breeds. Consequently, the learner became a role model for the whole school; the pioneering ICT research skills of the learner were used by all teachers to demonstrate the value of the internet as a source of content and the importance of acquiring e-learning skills.*

In summary, a conclusion that can be drawn from the evidence tendered by the teachers is that a digital divide phenomenon exists in the basic education classrooms. While teachers are lagging behind and in some cases reject the technology, learners are acquiring and improving their ICT skills.

8. RESULTS AND DISCUSSION

The first research questions sought information about the existence of digital divide between teachers and learners in schools. Participants unanimously agreed that a digital divide was present in basic education classrooms and the divide was in favour of the learners. Schools were experiencing problems such as shortage of computers, poor internet connectivity and lack of support from school administrators. The shortage of ICT infrastructure prevented teachers from experimenting with the technology to gain skills and the confidence necessary for successful integration. Instead of venturing into ICT supported instruction, teachers with some computing skills had no options but to continue using the chalk and talk method. Some teachers went as far as bringing their own computers to school to help learners and to provide other teachers with basic ICT skills. School administrators were expected to play a leading role in the digital transformation of learning institutions. Their responsibilities included mentoring teachers and providing them with in-service training opportunities. Evidence tendered by respondents indicated that school principals were not able to execute this key mandate. The main reason given was that head teachers had very limited ICT skills and had a tendency to be technophobic. Therefore, it is expected that a digital divide will be more prevalent in schools managed by principles with limited ICT skills.

The low level of access and use of ICT resources by practitioners was in sharp contrast to the situation being experienced by the learners. Learners were not only in possession of smartphones and laptops; they were also constantly upgrading their computing skills. Most learners acquired the equipment and skills from home but evidence show that learners from households with no computers were busy acquiring computing skills from their schoolmates. Secondly, the rapid acquisition of computing skills by learners was observed in spite of presence of anti-technology policies that were put in place by schools management teams. Learners might be bringing smartphones to school after having realized their usefulness as learning resources. For example, smartphone can be used to access up-to-date content on the internet and the content can be shared by a community of learners. On the other hand, school administrators and classroom practitioners who still consider the teacher as a source of knowledge maybe oblivious to the opportunities that are brought by digital resources. Consequently, schools that have drafted and implemented anti-technology polices will have classes that are characterized by a wide digital gap between the learners and the teachers.

The points that have been discussed above are largely out of the control of teachers. This does not mean teachers have no role in the process of ICT introduction in schools. As the main end-users of the technology in class, the perception held by the teachers toward the technological gadget determines whether the technology is adopted or rejected. The on-going digitization of the classroom appears to have put teachers in a situation where they had to decide whether to continue using traditional methods of teaching or embrace technology-based pedagogy. For some teachers, taking the new ICT route meant having to learn new ICT methods and techniques. Therefore, the ICT induced transformation of the learning and teaching space was viewed by some teachers as a development that had the potential to seriously undermine their professional status. This perspective made the teachers to eventually harbour negative attitude towards technology integration in schools. The negative sentiment was also reinforced by the

notion that ICT incorporation would increase the workload of teachers and weaken their authority in class. Therefore, the observed digital gap in schools is widening on a daily basis because teachers continue to be sceptical about the benefits of ICT integration.

Two demographic variables (i.e., age and gender) were also included amongst elements that have some influence on the observed digital gap. Age is strongly correlated with experience such that practitioners who have been in the field for a long time tend to be the most experienced. However, age also comes into focus as teachers who are just about to retire have expressed a strong dislike of ICT integration. One of the reasons advanced is that learning new ICT skills whilst a teacher is left with few years of teaching is a waste of time and resources. The skills acquired will not benefit the teachers once they leave the classroom and the money spend training the teachers could have been put to good use by recruiting and training new teachers. The message from the teachers is that if the technology has no relevance outside school, then the technology will be rejected regardless of whether it is useful in the classroom. Adoption and use of ICT in teaching was also observed to be unequal between males and females. Female teachers were noted as being more interested in the use of ICT than male teachers. Therefore, a wider digital gap should be expected in classes taught by long serving teachers as compared to classes under the supervision of younger teachers.

8.1 What is the Impact of the Digital Divide in the Learning and Teaching Process?

The general conclusion that can be made from the evidence is that the observed digital divide is having a negative impact on the teaching and learning process. Learners are fast acquiring ICT skills and the equipment necessary for introduction of e-learning. An increasing number of learners are now able to search for more comprehensive and up-to-date information on the internet. Teachers, on the other hand, continue to rely on the lecture method and textbooks to deliver content in class regardless of the technological competence of their learners. The observed dominance of teacher-centred methods in schools is detrimental to acquisition of 21st Century skills. The second point that demonstrated the undesirable effect of the digital divide on learning and teaching process is related to the school principals. Most school administrators have been characterized as people with very limited ICT skills. As a result, younger teachers with some ICT skills are often called upon to perform administrative duties that were supposed to have been done by the school managers. The concerned teacher is compelled to apply his/ her ICT skills in an environment that has no direct benefit to the learners. Therefore, the redeployment of teachers with ICT skills from the classroom to the administration block only serves to widen the digital gap and is a habit that sustains teacher-centric pedagogy. Also, learners are disadvantaged by the digital gap developing between the school and the home. While schools management teams are doing everything in their power to insulate schools from the digital revolution that continue to permeate all human endeavours, the technological winds of change are sweeping through communities surrounding the schools. On a daily basis, a learner has to migrate from a household that can only be described as a technological oasis to a school that fit the description of digital desert inhabited by technophobic personnel. Instead of being regarded as centres of excellence, enlightenment and innovation, schools will soon be viewed by learners as antiquated institutions that find it hard to evolve and transform themselves into 21-century learning centres.

8.2 How can the Digital Divide Problem be Solved?

Teachers who participated in the study were able to provide some answers to the question relating to how the digital divide problem could be solved. The suggested solutions were categorized into three groups; solutions targeting first-order barriers, solutions targeting second-order barriers and solutions focusing on the effectiveness of teacher training policies and programmes. First order barriers such as shortage of ICT infrastructure and lack of ICT skills can be dealt with by purchasing equipment and in-service training of teachers. Previous studies have also identified the barriers and suggested recommendations on how the problems could be alleviated [58]. Second-order barriers emanated from the negative attitude of teachers towards ICT infusion in the classrooms. One prominent factor that is thought to have precipitated the negative attitude is the top-down model used to introduce ICT in schools [9]. Under the top-down model, policy makers conceptualize the ICT integration project and expect teachers to do the implementation. The

model is based on the assumption that teachers in the field will dump the traditional teacher-centred methods in favour of the ICT-based pedagogy. Unfortunately, the evidence presented by the respondents in the current study is suggesting otherwise. Teachers, especially those who have been teaching for a long time, perceive technology as a threat to their professional status and aspirations. The problem can be alleviated by mounting large scale nationwide in-service training programmes to demonstrate the immense potentialities of ICT and how appropriate use of technology can save time and significantly reduce the workload of teachers. The objective of the demonstration model as suggested by Ertmer et al. [10] is to actively involve teachers so that they develop ownership of the ICT integration project. Since long-serving teachers have ICT needs that appear to be distinct, generic intervention programme may not yield desired outcomes. This group of teachers will have to be provided with short courses that are designed to show the value of ICT in education as well as its application in other sectors of the economy such as health, business and agriculture.

At the policy level, two intervention strategies are required. Quality of the pre-service programme may be operationalized as the extent to which the programme empowers teacher trainees in the three domains of subject matter knowledge, pedagogical expertise and technological competence. Three types of pre-service training models have been suggested in the literature [34]; each model is identified by the manner in which the three domains are configured. In Model 1, content and pedagogy courses are offered to teacher trainees but the two domains are treated as separate subjects. In most cases, Model 1 programmes existed before technology became widely spread and easily available. The two domains (i.e., content and pedagogy) are also taught in Model 2 programmes but a deliberate attempt is made to integrate the domains. From a teacher training perspective, Model 2 is of a higher quality because the programme creates the foundation for the emergence of PCK. The other element associated with Model 2 is that technology courses may be available but trainees are only exposed to the basics. Transitioning from Model 2 to Model 3 requires an amalgamation of the three elements of technology, pedagogy and content [34]. At this stage, technology is no longer regarded as a stand-alone subject or an additional resource that is available to teachers and learners. Rather, teachers are trained on how to use ICT to establish learning platforms that allows for collaborative and self-directed learning.

In Botswana, Model 1 programme started in the early 1960s. Prospective teachers were required to go through a two-year programme in order to be awarded a Primary School Teaching Certificate. Transition from Model 1 to Model 2 was initiated in 1993. The three-year period was not only aimed at giving trainees more time to acquire subject matter knowledge and pedagogical skills but it was also designed to created suitable conditions for infusion of the two domains. However, it has to be born in mind that the three-year programme was not specifically formulated to facilitate infusion of technology in teaching and learning. Put in a different form, majority of practitioners in field were not trained on how to integrate ICT in their lessons. To a large extent, the observed low ICT uptake in schools is a consequence Model 1 and Model 2 training systems. The long term solution then is for teacher training programmes to migrate from Model 2 to Model 3. This can only be achieved by promulgation of new ICT policies and programmes that will facilitates amalgamation of the three elements of technology, pedagogy and content. Upon graduation, teachers will be in possession of all ingredients that will help them to achieve the TPCK status.

The second policy related factor responsible for slow uptake of ICT in schools is lack of subject specialization. Public primary schools are still using the generalists approach which requires teachers to teach all subjects [25]. This makes teaching to be a complex undertaking with a load that is almost unbearable. Therefore, lack of subject specialization is counted amongst the prominent impediments towards successful uptake of technology in schools. A solution to this problem is identification and implementation of the most teacher friendly and learner focused subject specialization model. The model will assist teachers to develop TPCK sooner rather than later.

9. CONCLUSION

In this study, opinions and perceptions of teachers with considerable experience in the basic education system were collected using structured interviews and a focus group. The general conclusion was that a digital gap is present between learners and their teachers.

While learners were reported to be embracing technology with open arms, several challenges or barriers prevented teachers from adopting and using ICT devices. The challenges facing teachers in schools included shortage of ICT equipment, lack of training and technical support, internet connectivity issues, negative attitude towards ICT resources, lack of support from school management teams, technophobia and overloaded teaching schedules. The same impediments were highlighted in previous studies and researchers who conducted those studies provided possible solutions. The recommended solutions ranged from providing teachers with ICT in-service and pre-service training courses [75], making sure that schools have enough ICT hardware and software [76], including teachers in the decision making process [77] and introducing subject specialization [25]. For the in-service training workshops to be effective, teachers should be grouped according to their ICT readiness level (i.e., early adopters, early majority, late majority and laggards). Each group can then receive training that is aligned to their needs. Secondly, teacher training policies and programmes should be reformulated to bring them up to speed with rapidly changing ICT landscape and the ICT needs of teachers in schools.

10. STUDY LIMITATIONS

The sample used in the current study was small and this limits the extent to which findings can be generalized. However, the constructivist paradigm was applied in the study to enable deeper understanding of the nature and impact of the digital divide in schools.

FUTURE RESEARCH

Future research should explore the effects of the digital gap that is developing between the school and children's homes in urban, rural and remote areas.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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