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THESIS

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With the title:

The Use of Computers as a Tool in Teaching and Learning: A Case Study of Selected Secondary Schools in the Pinetown District.

FACULTY OF EDUCATION

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DECLARATION

I, MUNYARADZI SIKHAKHANE, hereby declare that this thesis entitled **'THE USE OF COMPUTERS AS A TOOL IN TEACHING AND LEARNING: A CASE STUDY OF SELECTED SECONDARY SCHOOLS IN THE PINETOWN DISTRICT',** is my own original work, and that all the resources that I have used or quoted have been indicated and acknowledged by means of complete references. It has been submitted for the degree of **DOCTOR OF PHILOSOPHY IN EDUCATION: CURRICULUM STUDIES**, at the University of Zululand. It has not been submitted for any degree or examination in any other university.

CANDIDATE'S SIGNATURE: ……

SUPERVISOR'S SIGNATURE: ……

CO-SUPERVISOR'S SIGNATURE: ……..

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DEDICATION

This thesis is dedicated to my wife, **ALICE ZVINAVASHE,** for her moral and spiritual support. I also dedicate it to my children, **BLESSING RAMIREZ, SIMBARASHE SIKHAKHANE** and **NGONIDZASHE EMMANUEL SIKHAKHANE** for inspiring me to continue working hard for it; and to my mother, **CECILIA THOKOZILE SIKHAKHANE,** for her motherly and gracious support.

ABSTRACT

Given the growing importance of computer technology, in consequence of the advent of the Fourth Industrial Revolution (Industry 4.0), and of the knowledge and skills necessary to enhance authentic teaching and learner performance and ultimate academic achievement, much profound research is being devoted to ascertain the practicality of the claims that the informed use of computers can suffice that demand in virtually all sectors of the educational, economic, health, environmental and political arenas the world over. This study aimed to explore the views of both teachers and learners about the use of computers as a tool for teaching and learning in the secondary school curricula; and the rationale that motivated it was the phenomenally limited research available about computer usage in developing countries, from which South Africa is not spared. Moreover, the research we have concentrates on a few "*special"* subjects like maths and sciences, which reflect computer usage, biased at the expense of the rest of the secondary school curricula. It is a shortcoming that requires research into the use –or, one fears, the neglect –of computers as a tool across the secondary school curricula. This study was considered significant because its findings could presumably be helpful in guiding e-Education and e-Learning policy formulation and effective implementation so that learners will exit secondary school prepared enough to face the challenges that come with Industry 4.0.

The qualitative paradigm was employed, and specifically, the case (Pinetown district secondary schools) study design was adopted. Data about teacher's and learners' views on the use of computers as a tool for teaching and learning was elicited through the use of semi-structured teacher interviews, semi-structured focus group interviews and classroom observation. A sample of six Grade 10 and 11 teachers and thirty learners (15 Grade 10s and 15 Grade 11s) was purposively selected by virtue of having computers in their schools. Findings revealed that computers were too superficially and irregularly used to enhance meaningful instruction and nurture learner academic achievement –a situation that was apparently due to the *scarcity* of computers for teaching any subjects other than computer applications technology, science, and maths. Rampant theft of computers was reported as wreaking havoc in the schools studied –hence the scarcity.

The study recommends that computer-integration modules be included as part of the pedagogical curricula for students in all teachers' training institutions so that teachers will be aware of how and when computer tools should be used in teaching and learning. In addition, a Technological Pedagogical Educational Psychology Content Domain (TPEPCD) model was proposed for possible adoption by teacher training colleges. The study strongly recommends that proper training and induction of school managers should be the Department of Basic Education's (DBE's) priority in framing e-Education policy. It is recommended that the DBE puts surveillance camera systems in all schools before supplying computers to its schools to prevent theft.

Keywords:

Authentic Learning; Computers; Computer software; Constructivism perspective; Continuing Professional Teacher Development (CPTD) management system; Fourth Industrial Revolution; Internet; Professional Learning Communities (PLCs).

LIST OF ACRONYMS

CAI	Computer-Assisted Instruction
CAL	Computer-Aided Learning
CBI	Computer-Based Instruction
CCAI	Cooperative Computer Assisted Instruction
CD ROM	Compact Disk Read Only Memory
CEPD	Content Educational Psychology Domain
CI	Convectional Instruction
CMI	Computer Managed Instruction
CPTD	Continuing Professional Teacher Development
CTPD	Content Technological Pedagogical Domain
DBE	Department of Basic Education
DoE	Department of Education
FET	Further Education and Training
ICAI	Individualized Computer Assisted Instruction
ICT	Information and Communication Technology
ITS	Intelligent Tutoring Systems
KZN	KwaZulu Natal
ND	No Date
OECD	Organisation for Economic Co-operation and Development
PEPD	Pedagogical Educational Psychology Domain
PLC	Professional Learning Communities
SABC	South African Broadcasting Co-operation
SMT	School Management Team
TCD	Technological Content Domain
TCEPD	Technological Content Educational Psychology Domain
THRASS	Teaching Handwriting Reading and Spelling Skills
TPCK	Technological Pedagogical Content Knowledge
TPD	Technological Pedagogical Domain
TPEPCD	Technological Pedagogical Educational Psychology Content Domain.
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
WWW	World Wide Web

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CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

In most societies of the world, the demand for an education system that is both nationally and internationally appropriate and relevant has become more prevalent than ever before. Computers seem to play a pivotal role in trying to satisfy this demand (Mikre, 2011; Brun & Hinostroza, 2014; Rabothata, 2017). Computers keep learners active, engaged in given tasks, thus promoting meaningful learning (Mdlongwa, 2012; Edutopia, 2014). The graduates churned out from the secondary education systems, which integrate computers into the teaching and learning process, are prepared to fit into this dynamic world. Concurring with the cited authors, and alluding to the advent of the Fourth Industrial Revolution, the Vice-Chancellor of a South African university was quoted (Butler-Adam, 2018:1) as unequivocally positing: “Workplaces will require adaptable people whose jobs are reimagined, enriched or facilitated by the technology they work alongside.” Oseghale and John (2014:266) seemed to share the same perspectives; they asserted that when computers are used in a constructivist approach, they can have tremendous potential to develop students' higher-order cognitive skills.

This chapter introduces the scope of the study with the specific importance of computer tools for teaching and learning, which involves the background of the study and research problem, outlining the field of study. It presented the aim, objectives, and research questions, and explained the operational concepts and chapter division used.

1.2 BACKGROUND TO THE STUDY

There is clear evidence that the use of computers improves the consistency and quality of instruction, makes learning more motivating for students, and extends access to hard-to-reach learners (Phipps & Merisotis, 2000; UNESCO, 2002; Gudza,

2010; Davidson, Richardson & Johns, 2014). From the above assertions, it is clear that the use of computers impacts positively in the teaching and learning process. Presumably, in congruence with Butler-Adam, Panyaza Lesufi, Member of the Executive Council for Education (2017:1), Gauteng Province, has pronounced that:

> the pace of developments in the digital economy necessitates a shift from traditional modes of teaching and learning to a curriculum that captures the spirit of the times and equips our children with the skills and competencies required not only for individual success but also for the success of our economy and our society at large.

Given this enlightenment, the researcher was left with no doubt that it is of utmost importance that all Departments (e-Education and e-Learning) of the Department of Basic Education (DBE) make some form of concerted effort to make sure that all secondary schools are sustainably equipped with relevant computer hardware and software to promote meaningful attainment of computer usage skills, for both teachers and learners, to enhance meaningful teaching and learning that may be regarded to be in tandem with the Fourth Industrial Revolution's requirements.

The use of computers, in trying to promote quality teaching and learning, has become commonly accepted by the world at large (UNESCO, 2012:7). The developed world has extensively studied the positive impact of computers in teaching and learning for about three decades now (Gudza, 2010; Davidson Richardson & Johns, 2014; Smith & Hardman, 2014). Furthermore, research evidence (Lee, Waxman, Wu, Michko & Lin 2013; Smith & Hardman, 2014) has shown that the impact of computers on academic attainment is a much-studied topic in the developed world, with numerous studies emanating from research in the United Kingdom and the United States. Condie and Munro (2007), cited by Smith and Hardman (2014), analyzed over 350 literature sources on the impact of computer usage, and noted that computers enhance effectiveness, hence have been used for many years in the developed countries of Europe and North America for a long time now. This shows that these developed countries have gone a long way in researching the impact of computers, and have therefore adopted the practice of always integrating this tool in their teaching and learning processes.

The general consensus, in the developed world, is that whatever impact computers may have in the education system they cannot take the position of the teacher (UNESCO, 2002; John & Sutherland, 2004; Isaksal & Askar, 2005; Milkre, 2011; Bhalla, 2013; Laaria, 2013). However, irrespective of the above consensus, the same researchers concur that computers enhance effectiveness in the classroom. This is also evident in the studies conducted by Page and Christian (n.d:1) when they say, “Although technology is not a substitute for quality teaching, it can enhance quality teaching”. The above assertions thus reflect that computers have a positive impact in the secondary education system, and one can conclude that the developed world is in the vanguard with regard to the use of computers and research on its impact in the teaching and learning process.

In contrast, the African countries seem to lag behind in terms of research and the use of computers in the teaching and learning process, which is evidenced by little or no literature. Research studies (Gudza, 2010; Smith & Hardman, 2014) confirm that developing nations are lagging behind simply because, by scale, many of their schools still lack the basic computer resources that would bring positive change in the teaching and learning process. Furthermore, Gudza (2010), Miller (2011), and Smith and Hardman (2014:24) reveal that there is limited research on the use and impact of computers in education in developing countries such as South Africa. Nevertheless Chile, India, Turkey, Botswana, Zimbabwe, Kenya, Nigeria and South Africa have some evidence of research carried out on the impact of computers in secondary education (Kelly, 1999; Isaksal & Askar, 2005; Inan & Lowther, 2010; Laaria, 2013; Dambudzo, 2014; Davidson, Richardson & Johns, 2014). The foregoing researchers reveal that these studies merely concentrate on a few sciences like biology, maths, chemistry and social sciences in these countries. This means the rest of the curricula are excluded. Similarly, bias towards certain subjects is also reflected through studies carried out by Osodo, Indoshi, and Ongati (2010:219), and Dambudzo (2014:1), who postulated that perennial problems of access to relevant computer tools impeded the teaching of geography in many schools. Page and Christian (n.d.) pointed out that learners can get lots of information from the Interactive World Atlas of 2007, where they can get a series of virtual field studies about geography. The problem is, therefore, the bias towards specific “special”

subjects at the expense of the rest of the secondary school curricula when integrating computers into the teaching and learning process in developing countries.

In South Africa research done was specifically on the effect of the use of MasterMaths (2007) and CAMI Maths (2009) on matric mathematics results in Western Cape Province (Smith & Hardman, 2014). The South African research findings indicate that some lower secondary classes are not included in these studies, although they constitute the foundation for good matric achievement. Hardman (2008) cited in Smith and Hardman (2014), states that MasterMaths was a Khanya Project meant for matric mathematics. It is computer-assisted instruction (CAI), which is only good for drill and practice and not for promoting authentic learning. This shows a gap that needs to be covered. Firstly, that research covered only one out of nine provinces, and secondly, it is skewed towards mathematics, leaving out the impact computers, in general, could have on the rest of the high school curricula. Moreover, CAI does not promote authentic learning, which can hamper quality teaching and learning.

South Africa is also offering the THRASS (Teaching Handwriting Reading and Spelling Skills) training program for primary school teachers through Wits University (Gudza, 2010). THRASS teaches phonics in English primary schools, which means secondary schools are left out. It excludes the rest of the subjects that make up the curricula, hence these subjects are unable to be incorporated. This is another indicator of a serious gap as THRASS covers only primary schools, leaving out secondary schools, and is offered only through Wits University. Gondo (n.d:14) laments:

> We want to see a teacher teaching History, Geography ... or any other subject using the THRASS approach ....so that it permeates across the curriculum because wherever you are using English you want the children to understand the words and the spelling and the articulation.

In concurrence with Gondo (n.d.); Kevogo, Toili, and Mutsotso (2013:017) assert that the integration of computers in the teaching of biology enhances students' achievements. This is another shortfall that needs to be overcome if computers are to have a wholesome and meaningful impact on teaching and learning in secondary schools.

According to the National Survey of ICT in South African Schools (Howell & Lundall, 2000), the disparities are also conspicuous in the way computers are distributed. The survey reveals that of the nine provinces, Gauteng has 606 computerised schools (26.2%), followed by the Western Cape with 545 schools with computers (23.6%).KZN, which has the highest enrolment, has only355 schools with computers (15.4%). Garson (1999:14), cited in Howell and Lundall (2000), in the same survey, states that further disparities are clear in the same privileged provinces, with computer resources (88,6%) concentrated in urban elite schools. Howell and Lundall (2000), in their study of the use of computers in South African schools, state that the challenge is not only a lack of computer resources but also how teachers use the few available educational devices for teaching and learning. Wilson-Strydom (2005) asserts that the capacitation of teachers is one of the key areas that need to be addressed if computers are to have a meaningful impact on teaching and learning. This study, therefore, seeks to shed light on the use of computers in teaching and learning across the curricula in secondary schools.

1.3 STATEMENT OF THE PROBLEM

In a democratic sovereign state like South Africa, research information about the impact of computers on teaching and learning should be abundant, but very little research information is available. Nevertheless, the developed world's research information indicates that computers improve students' academic attainment in secondary schools since they motivate students to be kept engaged on tasks and wanting to learn more as they collaborate with their teachers and peers (Mdlongwa, 2012:5). The developed world seems to reveal most of this information much more than developing nations like South Africa (Mdlongwa, 2012; Mdzebele, 2013). If we continue to ignore this lack of research information on the use of computers across the curriculum, we will experience a sluggish paradigm shift in computer policies, and fail to catch up with 21stcentury educational requirements for the new generation.

Surprisingly, the little research information available is biased towards a few science and maths subjects. In contrast, Osodo et al. (2010) and Dambudzo (2014) observe

that technology promotes learners' engagement and motivation resulting in better achievements in geography. A major problem is that there is little or no research information about the impact of computers across the secondary school curricula, yet the government is initiating changes that could result in students' positive academic attainment (Mdlongwa, 2012). A government initiative is evident in the Teacher Laptop Programme (2012), which was rolled out to assist teachers to improve their teaching strategies so as to enhance excellent learner academic achievement (Department of Basic Education, 2012). The idea was suspiciously received in the teaching fraternity and failed to materialize (Smith & Hardman, 2014). There is thus a need to explore the use of computers in teaching and learning in secondary schools across the curricula (in the FET band of Grades 10 and 11) so as to ascertain the extent of this tool.

1.4 AIM OF THE STUDY

This study aims to understand, comprehensively, the use of computers as a tool in teaching and learning across the curricula in secondary schools in the FET phase.

1.4.1 Objectives of the study

The proposed objectives of this research are to:

- Explore teachers' views about using computers as a tool in teaching and learning in secondary schools.
- Explore learners' views about using computers as a tool in teaching and learning in secondary schools.
- Identify the kinds of classroom support and guidance that are available to teachers to facilitate the use of computers as a tool in teaching and learning in secondary schools.

1.4.2 Research questions

This research proposes to answer the following questions:

- What are teachers' views about the use of computers as a tool in teaching and learning in secondary schools?
- What are learners' views about the use of computers as a tool in teaching and learning in secondary schools?
- What kinds of classroom support and guidance is available to teachers to facilitate the use of computers as a tool in teaching and learning in secondary schools?

1.5 INTENDED CONTRIBUTION TO THE BODY OF KNOWLEDGE

This study may contribute to allaying fears and misconceptions about the fact that computers as a tool of teaching and learning can disturb the learning process, and should promote much more relevant planning of curricula for teachers and the ultimate supervision of student teachers. The study also seeks to yield evaluative information that will be at the disposal of the Department of Basic Education (DBE) planners, school management teams (SMTs), educators and students. It promotes the importance of being in touch with world educational trends in accordance with the requirements of the digital era (the Fourth Industrial Revolution era). The researcher presumes that this study's revelations will encourage the DBE to be more proactive and practically oriented in terms of what good teachers' professional repertoire should embody in the wake of the technological demands of the Fourth Industrial Revolution. The policymakers will be able to make decisions from an informed perspective. The recommendations may be used to promote efficient and effective use of computer technology in education. The results of this research may also stimulate more profound research in primary schools, thus improving the teacher curriculum in teacher training institutions.

1.6 DEFINITION OF OPERATIONAL TERMS

It is critical to clarify the following terms that were used within this study.

1.6.1 Authentic learning

“Authentic learning typically focuses on real-world, complex problems and their solutions, using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice” (Lombardi, 2007). The researcher concurs with the author and further presumes that “authentic learning” could be synonymously viewed from the perspective of experiential learning where learners would be hands-on, using computers, in their learning process.

1.6.2 Computers

A computer is a programmable electronic device that systematically accepts, processes data and stores information that is usable to solve specific problems (Dill, Francis & Nunkumar, 2014:4). It is a tool or technology used to complement the teaching and learning pedagogy, promoting independent and critical thinking and collaboration amongst teachers and learners in secondary schools. A computer is taken, in this study, as a tool of the digital age that promotes connectivity in the teaching and learning process. Osodo et al. (2010:219) assert that it “provides new opportunities for teaching and learning [to] reach more learners”.

1.6.3 Fourth Industrial Revolution

It “can … be regarded as a clever factory system in which cyber-physical systems monitor the physical processes of factories and make decisions”(Bolat & Bas, 2018:149). Among other things, internet tools, simulations, and autonomous robots constitute the conceptual facets of the Fourth Industrial Revolution.

1.6.4 Internet

The name refers to the international networking of computers (Banda & Mupinda, 2000; Dill et al., 2014:202). In this study “internet” is defined as a computer tool that promotes timeous and real-time collaboration of teachers and students in teaching and learning in secondary schools.

1.6.5 Computer software

“Software is a program…that tells the computer and its devices what to do”, (Dill et al., 2014:44). It refers to a suite of programs (operating and application) used by both teachers and learners to enhance the attainment of excellence in student attainment in teaching and learning in secondary schools. This software should be tailor-made to serve relevant purposes per specific specialty, e.g., software for geography, life science, history, etc.

1.6.6 Constructivism perspective

A constructivism perspective is a pedagogical approach that prefers a student-centered to teacher-centered approach in teaching and learning (Imenda, 2012:14). This perspective promotes that learners become more active through collaborating in the construction of their own knowledge. Computers are assumed to be facilitating it through the internet, emails and the worldwide web.

1.6.7 Professional learning communities (PLCs).

Professional learning communities are where teachers collaborate in sharing curricula and pedagogical issues. In PLCs, teachers share and learn new tactics of teaching to promote excellent learners’ academic achievements.

1.6.8 Continuing professional teacher development (CPTD) management system

The CPTD management system is a continuing professional teacher development that is meant for ongoing capacitation of teachers. The purpose of the CPTD is to ensure that teachers are in touch with current educational trends.

1.7 CHAPTER DIVISION

Chapter 1: This chapter serves to introduce the study. It presents the problem statement, purpose, and significance of the study, research questions and objectives, definition of operational terms, and finally a summary of the chapter, which includes brief information about the organisation of the study.

Chapter 2: This chapter focuses on the theoretical framework in which the study is grounded, which is connectivism as the theory of the digital age. The chapter also reviews related literature.

Chapter 3: This chapter focuses on the research design and methodology that are followed to conduct this study. It covers the paradigm, design, targeted population and sampling procedures, with detailed information on instruments used for data collection and the processes of data analysis.

Chapter 4: This chapter focuses on the presentation and analysis of collected data. It concludes by presenting a summary of the main findings of the study, which is done in accordance with qualitative research requirements.

Chapter 5: This chapter presents a summary of the study. It also makes concluding remarks based on the information presented, followed by recommendations in light of the study findings, and conclusions for future improvements in policies concerning teaching and learning in secondary schools. This chapter also includes suggestions for undertaking further research in areas not covered by this study.

1.8 CHAPTER SUMMARY

This chapter introduced the scope of the study. It briefly provided the background of the research problem, outlined the field of study, presented the aim, objectives, and research questions, and explained the operational concepts and chapter division used. The following chapter presents the theoretical framework that underpins the study and a review of the related literature.

CHAPTER 2
THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, literature is reviewed in the context of the use of computers as a tool in teaching, and how learners benefit through their application inside and outside the classroom to ensure their satisfactory academic achievement. This chapter begins with a discussion of the theoretical framework in which the study is grounded. Contextualisation of the use of computers as a tool in teaching and learning in the South African educational system is also reviewed at length. In contextualising the use of computer issues such as the South African e-Education policy, challenges of computer education and the corresponding national strategy for supporting the use of computers are discussed in detail. The literature on trends in developed and developing nations on the use of computers and its relevance to teaching and learning in their educational systems are also reviewed. Furthermore, this chapter review shows how teachers and learners make use of Computer Assisted Learning (CAL), Computer Managed Instruction (CMI) and Computer-Assisted Instruction (CAI) in different subjects. Learners' and teachers' perspectives, on the extent to which computers are considered an invaluable tool, are reviewed as well as the importance of the kind of support provided to ensure efficient and effective use of this tool in the secondary school curricula.

2.2 THEORETICAL FRAMEWORK

The theoretical framework in which this research in grounded is connectivism: the Theory of the Digital Age (Siemens, 2005). Downes and Siemens (2009), as cited by Duke, Harper, and Johnston (2013), are the theorists associated with this theory. The basic tenets in connectivism are grounded in the fact that learning and knowledge rest in the diversity of opinions and that learning of new things may be found in non-human appliances, which in this case is the computer as a tool of teaching and learning. Learning is well known as a process of connecting, and nurturing connections and information sources or nodes, which promotes the fact that learning

becomes more critical than knowing. This theory is well known for its principle which emphasizes the fact that learning should be regarded as an ongoing process because knowledge and information change exponentially, as the right answer today may be wrong the following day or in years to come owing to alterations continuously taking place within the complex education systems highway of today. Another tenet is the emphasis placed on the aspect of currency: that is, learning activities have to be up to date and accurate in accordance with what is demanded in the world market.

This theory of connectivism, more specifically in relation to learning, emphasizes the use of computers to enhance effectiveness and keep learners abreast of current educational trends in this dynamic world. Over the last three decades technology has reorganised how we live, communicate, teach and learn (Siemens, 2005; Sahin, 2012). Siemens (2005) postulates that learning needs and theories for learning should be reflective of the underlying social environments. Vail (2005) affirms that learning should embody a set of attitudes and actions by individuals and groups, which they employ to keep abreast of the novel, obtrusive and recurring events. Vygotsky (1978) mentions that tools allow students to explore discover and construct knowledge, thereby promoting higher student achievement. He says that this tool motivates students and exposes them to the same content in different contexts. Therefore, computers as a learning tool can have a positive impact on teaching and learning by providing stimulating, motivational, challenging educational activities through collaboration and constant feedback.

With reference to connectivism, there is much research evidence (Gonzalez, 2004; Siemens 2005; Aidahdouh, Osorio & Caires, 2015) that learning is affected by technology. The foregoing authors concur that computers are “rewiring” our brains because they define and shape our conception of the world. Many learning activities and processes, especially in the developed world, are now handled by computers. Computers have become part and parcel of our lives. According to a research report on the impact of technology, students became aloof, disengaged and withdrawn when technological tools were removed from them for just one day (*New York Times*, 2010). Sometimes, consciously or unconsciously, we feel computers influence our learning through web-based assessments, research and even through sharing of information in Professional Learning Communities (PLCs). Siemens (2004:1)

asserts, "Know-how and know-what are being supplemented by know-where (understanding where to find the knowledge needed)". Knowing where to get information for learning promotes better attainment in academic endeavors. The advent of computers into our lives allows the cognitive development of students to take place in a fast and rich way.

Siemens (2005) claims that knowledge is gained through experiences and deliberate construction. Computers provide the platform for students to share experiences and apply profound thinking as they explore available facilities. The use of computers, as a learning tool, motivates students to interact with phenomena and question deeply why things occur the way they do, which promotes the construction of their own knowledge. Driscoll (2000), cited in Siemens (2005), asserts that learners are not empty vessels and that they should not be just filled with knowledge. They must be actively engaged in the process of creating meaning from their social experiences. Vygotskian theory (1978) alludes to the above perspective when it stresses the important role of social interaction in children's cognitive development. In Theme 1 of Vygotsky's account (1978), the importance of social interaction is stressed as an essential aspect that promotes children's cognitive development. He later emphasizes the important role played by the teacher, peers, and tools in Theme 2 (The More Knowledgeable Other). In this theme, it is reflected that computer tools have a significant impact on teaching and learning whereby they promote student-centered approaches in learning. Computers motivate students to construct their own knowledge and pace their learning in accordance with their abilities. From the foregoing assertions, it becomes clearer that computers facilitate connections where sharing and collection of knowledge takes place.

According to Siemens (2004), connectivist theory highlights that computer networks, power grids, and social networks function on the principle that people, groups, systems, nodes, entities can be connected to create an integrated whole. Through networking, computers promote cross-pollination of learning communities. This theory clearly demonstrates that computers are a vital tool that enhances effectiveness in teaching and learning. In view of the foregoing, Siemens (2004) states that the acquisition of learning and knowledge rests in the diversity of opinions, a point which supports the importance of collaboration through computers. He asserts

that learning may be found in non-human appliances, which in this regard is the computer. Connections through this tool allow the capturing of up-to-date knowledge. Computers allow teachers and learners to be connected with significant individuals in a conducive environment at the right time. It is clear that the connectivist approach impacts on teaching and learning in a positive manner.

Siemens (2005:5) concludes, "The pipe is more important than the content within the pipe". This points out that knowledge grows and evolves exponentially, which means access to what is desired most is more important than what a learner currently possesses. In today's global village, this is very relevant as learning is no longer individualistic but rather a collaborative process with tools, coaches, and peers. From the foregoing, the researcher can conclude that computers, as a learning tool, have a dynamic impact on teaching and learning. Chen (2015) proposes, in regard to the implementation of the Zone of Proximal Development (ZPD) theme in Vygotskian theory (1978) that knowledge of this social learning theory promotes differentiation of instruction in accordance with individual student needs and pace. Therefore, computers, as a tool, are vital through web-based applications, which allow learners to work even outside the classroom area.

Connectivism is relatively new, thus it may be difficult to be perceived by many as a learning or pedagogical theory. The researcher, however, perceives it as very relevant since technology should be playing a leading role in every classroom. Owing to the advent of the Fourth Industrial Revolution, all educational institutions are expected to meet learners' needs through the integration of 21st-century skills. As stressed in the previous paragraphs, it promotes a higher level of cognitive development such as knowledge construction, evaluation, and synthesis. Its major advantage is that it promotes cross-pollination of learning communities and knowledge. However, the application of this theory is solely dependent on electricity, be it alternating or direct current, meaning no electricity, no teaching and learning, which results in disengagement and aloofness in the learning communities. However, whatever pitfalls this theory may reflect, it is relevant to the objectives of the study, especially on the kind of support teachers and learners need to ensure authentic use of computers as a tool of teaching and learning.

2.3 EMPIRICAL STUDIES ON THE USE OF COMPUTERS AS A TOOL IN TEACHING AND LEARNING

The use of computers in the classroom brings more advantages than disadvantages, that is, if they are competently used (Evoch, 2007; Gudza, 2010; Tamim, Bernard, Borokhovski, Abram & Schmid, 2011; Shopova, 2012; Bhalla, 2013). In a comparative analysis of the digital skills that students had acquired, and of living environments designed to develop such skills, the Organisation for Economic Cooperation and Development (OECD) (2015:4) posits:

> Technology can enhance experiential learning, foster project-based and inquiry-based pedagogies, facilitate hands-on activities and cooperative learning, deliver real-time assessment, and support learning and teaching communities, with new tools such as remote and virtual labs, highly interactive non-linear courseware based on the state-of-the-art instructional design, sophisticated software for experimentation and simulation.

Subsequently, Gudza (2010), the Director for World Links Zimbabwe, stated that since teaching is a complex art, it requires teachers to vary their instructional strategies so that the minds of students are kept focused, thus ensuring maximum benefits. In view of the foregoing, it is therefore imperative, that efficacy in computer use in teaching and learning should be part of every teacher's professional repertoire.

In relation to e-Learning, many researchers (Gudza, 2010; Shopova, 2012; Cheok & Wong, 2015) assert that computers have a significant impact as they enable quick, timeous and quality feedback from both students and teachers. The foregoing authors contend that motivation and meaningful socialisation is achieved through the use of computer tools such as the internet and emails. Nevertheless, Lee, Waxman, Wu, Michko and Lin (2013) claim that irrespective of how objectively or subjectively internet and email may be regarded as important, it all depends on how the teacher supervises and guides learners to use these relevant websites and emails for sharing educational information. They warn that otherwise, without proper guidance, such tools may do more harm than good, as some learners' attention may be derailed by

unnecessary aspects. The researcher agrees with the foregoing researchers when they write that for desired educational goals to be accomplished the teacher is faced with the challenge of having to spend a lot of time monitoring the use of computer technology by the learners in order to promote teaching and learning. Nonetheless, the level of monitoring of learners, using the above tools, may depend upon the level of computer efficacy and dedication on the part of the teacher.

Computer use in teaching and learning has been researched for more than three decades now, especially in the developed world (Taylor, 1980; Sparks, 1993; Noble, 1996; Banda & Mupinda, 2000; Milkre, 2011; Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011). Computers are known to have an excellent impact on improving learners' performance in North America and Europe (Milkre, 2011; Tamim et al., 2011). Kruger (2010) asserts that the use of computers motivates learners' to learn individually and collaboratively as language deficiency is compensated for.

According to the Policy Brief Number 80, August 2012, of the Africa Institute in South Africa, the Research Intern of the Sustainable Development Programme, the Research Intern, Mdlongwa (2012:3) stated that there is little research on computer uses and impact in South Africa. However, studies to that effect mostly reflect the picture of private and well-resourced fewer government schools. This scenario is a manifestation of an entrenched gap and digital divide, in terms of computer usage research information, which needs to be attended to if international educational standards are to be achieved and maintained. Furthermore, Mdlongwa (2012:3) observed that the little research available concentrates on science and maths subjects. This gap is equally evident in the study conducted by Milkre (2011) in Ethiopia (2014):asserted that the use of simulation software in sciences allows learners to achieve better marks. Milkre stated that in primary schools when tutorial software is used learners score higher marks in reading skills. The level of skewness towards sciences is still noticed in Ethiopia too, as is bias towards primary schools. The above research showed that much still needs to be done in researching the impact of computers as a tool for teaching and learning across all the curricula in South African secondary schools.

Computer use allows teachers and learners to move away from traditional to more effective methods in teaching and learning, thus promoting multifaceted benefits in education (Department of Education, 2003). The then Minister of Education, Naledi Pandor, in her foreword about transforming learning and teaching in South Africa to White Paper 7, alluded to the fact that the White Paper was the government's response to a new ICT environment in education (Department of Education, 2004:6). She asserted that the digital media have revolutionised the transmission of information, resulting in dramatic changes in the way teachers teach, and have inevitably improve the learning process. She explained that new learning opportunities were being opened, through the provision of new technology, enabling learners and teachers to have access to current and more diverse educational resources thus promoting favourable networking and collaboration, and ultimately stimulating authentic learner academic achievement (DoE, 2004:6). Although the contents of White Paper 7 articulate an essentially visionary educational scenario, the current researcher noted that the topical challenge lies in how teachers will ensure meaningful implementation so that authentic learning and teaching can take place in alignment with digital era requirements as enshrined in the White Paper.

Mdlongwa (2012:6) asserted that computer technology plays a pivotal role as a resource which is seen to be more effective in supporting student-centred, collaborative and independent learning through provisioning of scaffolds for all learners of varied calibres and backgrounds, allowing room not only for acquiring knowledge, but above all for constructing knowledge and creating new learning experiences. However, the researcher strongly feels that the student-centred approach is only possible if class sizes are reasonably small, coupled with meaningful teacher computer efficacy, teacher support and effective guidance of learners.

Mdlongwa (2012) carried out comparative research at Pearson High School and in three other schools in the Eastern Cape on teachers' and learners' challenges in the use of Information and Communication Technology (ICT), of which computers are part, aiming to establish the extent of its use in teaching and learning. His study revealed that, despite a plethora of challenges encountered in the use of technology in South African schools, its efficient use would enhance authentic teaching and

learning, giving learners or graduates a comparative advantage in coping with and competing in an ever-changing global knowledge economy.

The foregoing is the general national and international perspective about using computers as a tool in teaching and learning. From Mdlongwa's findings it becomes unequivocally clear that despite challenges, computers can revolutionise teaching and learning in our secondary schools. The researcher feels that it was unethical to state the name of the school, Pearson High, in which the author carried out the investigation. However, the findings do much to improve the way we should use computers as a tool across the secondary school curricula.

The George Lucas Educational Foundation in the United States of America and other countries (Edutopia, 2014) concur that the use of computers encourages learners to stay engaged in their tasks, thereby reducing behavioural problems in the classroom. In this case learners appear to be more intrinsically and extrinsically motivated as they enjoy looking for information on their own (Edutopia, 2014). Research evidence (Ross, Morrison & Lowther, 2011; Ndlovu & Lawrence, 2012) indicates that computer integration by teachers, to promote meaningful and effective student-centred learning and a student-directed curriculum, has been a topic of in-depth discussion both in South Africa and the rest of the world.

A conference held at the University of Cape Town from 3 to 7 September 2012, a paper entitled "Towards Carnegie III" about strategies to overcome poverty and inequality was presented (Ndlovu & Lawrence, 2012:1). In this paper Ndlovu and Lawrence posited that the South African government had made commendable inroads in trying to intervene in promoting equity and equality in schools that historically were disadvantaged by having limited educational resources, hence were failing to achieve better results, especially in mathematics and sciences. These authors stated that the government presumed that introduction of modern technology could ameliorate the dismal failures in the registered category of schools. However, the PanAfrican Research Agenda (2008-2011), as cited by Ndlovu and Lawrence (2012:1), asserts that despite such sterling efforts by the government negligible progress was realised owing to lack of teacher proficiency ineffectively and efficiently using computer tools to enhance learner performance. Findings from their study

reveal that there was a gap created by government's efforts, which showed bias towards maths and sciences. Lundell and Howell's (2000) study, as cited by Ndlovu and Lawrence (2012:2), about the use of computers in South African schools, declared that "the problem is not caused by the lack of resources, but how teachers use the available educational tools in their teaching.… teachers with limited resources do not maximise the use of computers for pedagogical purposes." Concurrently, Bhalla (2013:174) carried out a detailed comprehensive study about the manner and the extent of computer-use by teachers in India, which involved a sample of 300 school teachers. The author used a questionnaire as an instrument for data collection. From this study the author's findings (Bhalla 2013:175) indicated, "Despite the initiatives … by different government organisations … and the ever-increasing use of technology worldwide … computers are not being used effectively by the teachers … teaching various subjects". From the foregoing revelations the present researcher therefore, concluded that even if computers are good tools for teaching and learning, they will remain "white elephants" in our schools for as long as they are little used, or virtually not used at all owing to teachers' lack of competence, guidance and support.

Other research evidence (Bhalla, 2013; Mdzebele, 2013) indicates a number of internal and external barriers that have a bearing on the extent to which teachers effectively use computer technology. These researchers identify the barriers as, respectively, a lack of resources, training and support, and of teachers' confidence and beliefs about how learners learn. Thus, the argument put forth is that although resources, training and support are available, computer technology may not yield positive results if it is ill-positioned for teachers and learners to access it timeously. Centralisation of computers may inhibit their beneficial use in the teaching and learning process.

According to Laaria (2013), successful implementation of computers in teaching and learning largely depends on the school management to manage change. However, poor implementation of computer technology policies in schools is due to management being less active or not having much knowledge about the importance of computers in teaching and learning. Referring to issues of access and adequacy of computer technology, Bhalla (2013) asserts that no meaningful computer impact

may be realised if teachers and learners fail to access this technology at the right time and place. On the other hand, whatever plethora of external and internal barriers have been observed by the foregoing researchers, in the past 30 years computers have been seen to be playing an effective complementary pedagogical role in the curriculum which can revolutionise teaching and learning (Edutopia, 2014).

During an interview on eLearning Africa News in February 2010 concerning perspectives on ICT and development, making specific reference to problems that were wreaking havoc in the Zimbabwean education system due to economic meltdown, the Director of World Links Zimbabwe and member of the eLearning Africa organising committee, E. Gudza (2010), asserted that through different websites computers allow learners access to a variety of current learning materials. Edutopia (2014), through its aforementioned studies in this chapter, observed that through the use of website tools learners are motivated and are kept engaged, as these tools appeal to their senses. In relation to Zimbabwe's and Denmark's cultural collaboration, Tustesen (2010), a secondary school Danish teacher, stated that computers change the way teachers teach, offering them effective ways to reach different types of learners and assess them in a number of ways, thus enhancing teacher-student relationships.

However, a descriptive survey (Kevogo, Toili & Mutsotso, 2013:28) about the general impact of computers on secondary school students' performance in biology in the Pre-Kenya Certificate of Secondary Education assessment and national examinations in Vihiga County, revealed that frequency of computer use had no significant correlation with performance in biology. Although they used a very large sample of 1003 students in their survey, the researcher does not personally believe that their findings were generalisable as they merely focused on the effects of computer use on only one subject selected from the curricula. The researcher would nevertheless conclude, from the vast literature reviewed, that proficient use of computers as a pedagogical tool in various subject areas promotes the idea that teachers play the role of coaches, advisers and content experts, thus encouraging learners to be more active and construct their own knowledge. Edutopia (2014) observes that computers should always support and reinforce learning that is taking place, and never precede it. Organisation for Economic Co-operation and

Development (OECD) (2015:4) asserts, “Technology can amplify great teaching but great technology cannot replace poor teaching.” This could mean that computers are as good as the teacher who uses them. When the teacher knows the relevant websites and coaches learners on how and when to use them, only then may positive effects be realized.

United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2012) suggests that for effective integration of computer technology in classroom teaching it needs to be well planned, thus allowing students to become more engaged and take control of their learning. It has been observed that without an ongoing and sustainable teachers’ professional development programme in South Africa computers may be difficult to use effectively in classroom teaching and learning. UNESCO (2012) strongly suggests that when technology is readily available to teachers, even though they have no computer expertise they need to be able to grab the golden opportunity and seek the necessary training to enable them to effectively use it. UNESCO (2012) affirms that this positive approach would allow the teacher to transform and improve his/her teaching so as to have a positive effect on student learning. Therefore, being keen to learn is a necessity for teachers so as to benefit student learning.

Incorporating the concept of Web 2.0 in our schooling systems helps elicit student participation and engage them more as active individuals (Gudza, 2010). In the light of Gudza’s assertion, the researcher feels that making more practical research information available is vital to promote better pedagogical tactics which are in tandem with 21st century digital educational requirements. Ross, Morrison and Lowther (2010:30), who conducted a detailed and comprehensive three-year study about the impact of technology on learning in the USA which employed a mixed-method approach involving a gamut of designs such as quantitative, qualitative and experimental, found that educational technology research information is of utmost importance to ascertain the extent of such technology’s effectiveness, and make appropriate changes for future teaching and learning strategies. Taking into cognisance the exponential usage of technology in teaching and learning, Ross et al. (2010:17) examined past and present technological research so that more and authentic research information could be revealed for better e-education policy

formulations and implementation, thus enhancing informed instructional strategies. They postulated that comprehensive research information promotes better usage of computers to enhance meaningful teaching and learning. The researcher strongly concurred with Ross et al. (2010) because research information allows the DoE to make informed decisions, which promotes better learner academic achievements. The researcher strongly perceives that the use of the mixed method approach (qualitative and quantitative), used by Ross et al (2010), can make research findings more reliable, thus increasing their generalisabilty.

It is the researcher's view that depriving learners of the internet, and the Web 2.0 social networking technologies, can undoubtedly make them show withdrawal and anxiety symptoms similar to those of drug and alcohol addiction (*New York Times*, 2010) because technology becomes part and parcel of their daily lives. The researcher, however, believes that more practical research is urgently needed on making computer-assisted Instruction (CAI), computer-assisted learning (CAL) and computer-managed instruction (CMI), can be made available to teachers, because most research concentrates on the theoretical benefits of computers in teaching and learning. Mathevula and Uwizeyimana (2014:1087) carried out a quantitative study, using a sample of 146 teachers from Limpopo provincial rural secondary schools, to investigate challenges encountered by teachers in integrating ICT in teaching and learning. In a nutshell, their findings, among others, were that teachers lacked the necessary abilities to use computer tools effectively for teaching owing to the minimal computer training they had received.

Mathevula and Uwizeyimana (2014:1090) assert that teachers cannot be expected to keep in touch with the latest software and hardware because of its complexity. They say that it must be through the use of more effective teaching practices that the educational benefits of certain types of software can be made available to students. UNESCO (2012) suggested that teachers needed only to know that web pages can be created, and that they are endowed with a myriad of resources, which can be carefully chosen and integrated into classroom situations.

Literature thus far reviewed indicates that studies in the developed world on the impact of computers in teaching and learning have focused on the role the tool plays

in enhancing students' academic achievements (Ross et al., 2010; Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011; Shopova, 2012; Cheok & Wong, 2015). Their research indicates that computers motivate students to work independently and collaboratively, promoting critical thinking, and providing them with the opportunity to pace their learning according to their individual ability.

Research evidence (Ross et al., 2011; Bhalla, 2014) indicates that developed nations have better resourced schools in terms of computers and human resources by virtue of their well-performing economies. Funds, a positive attitude and ongoing professional development of teachers fare needed for computers to have the intended impact in teaching and learning. The researcher therefore ponders whether teachers in the area under study have had the necessary support that could allow them to effectively use computers in teaching and learning.

As for developing nations, literature has indicated that they are seriously lagging behind in terms of research on the use of computers in teaching and learning, particularly in South Africa (Mdlongwa, 2012:1). The little that has been done is biased towards science and maths subjects. According to the *National Survey of ICT in South African Schools* (Howell & Lundall, 2000:3), the disparities are also conspicuous in the way computers are distributed. The problem with the above survey is that it is too outdated to give the researcher the current picture of computers that are currently in schools and in use. Although information is available that government and its partners in education have distributed computers to schools, information on implementation of this tool is scarce.

Generally, research done on the impact of computers reflects the picture in the developed world. There are few studies about the use of computers across the secondary school curriculum, especially in South Africa. Worse still, as indicated above, information about the distribution and use of this technology is not up to date enough to rely on. Another problem is that the limited research in South Africa shows bias towards science and maths subjects.

2.4 CONTEXTUALISING THE USE OF COMPUTERS AS A TOOL IN TEACHING AND LEARNING WITHIN THE SOUTH AFRICAN EDUCATIONAL SYSTEM

Quality education is resource essential for the production of quality human capital the world over. The positive growth and development of any country and its people rests on the shoulders of those teachers who integrate modern technology in their teaching strategies to make learning more effective and flexible (*The Mercury*, 19 January 2018). In a comparative international analysis of the digital skills which students had acquired, OECD (2015:3) posits, "Students who are unable to navigate through a complex digital landscape will no longer be able to participate fully in the economic, social and cultural life around them." The researcher strongly feels that preparation of quality human capital means that people become confidently ready to offer services that promote excellent socio-economic, environmental and cultural advances which meet 21st century requirements and those of the Fourth Industrial Revolution.

The Department of Basic Education (DBE) has recently introduced a Continuing Professional Teacher Development (CPTD) system to assist teachers to be kept abreast of current trends in education (DBE, 2011). In 2010 a teacher laptop programme was introduced to promote a revolution in teaching and learning (DBE, 2012). The DBE seems to be welcoming change when it asserts that because technology constantly changes it is vitally incumbent upon teachers to keep abreast of new trends in both pedagogy and computer technology for better performance (Mdlongwa, 2012). Teachers can form professional learning communities (PLCs) to promote system-wide capacity building for sustainable improvement, which promotes effective teaching and pupil learning (DBE, 2011). The DBE proposes that through PLCs, with the use of computer facilities, a shared vision can be achieved on the integration of technology in teaching and learning since this is done through cooperative discussion and reflection.

However, using a quantitative paradigm, Mathevula (2015) collected primary data through the use of a questionnaire from 12 schools in Groot Letaba Circuit in Mopani District in Limpopo Province, and found out that computers were merely used for administrative and personal purposes instead of authentic teaching and learning in

accordance with policymakers' intentions. Computers were used as stand-alone gadgets owing to lack of internet connectivity, which meant that no or little collaborative work amongst teachers and students prevailed, especially outside school hours, hence no sharing of educational information (Mathevula, 2015:113). This situation, prevailing in Groot Letaba Circuit, shows that the South African government is not walking its talk as is enshrined in the e-Education policy where it emphasizes prioritization of rural schools in terms of equitable support with the aim to ameliorate the failure rate in maths and sciences. The researcher, therefore, in line with research objective three, shows that without necessary support computers as a tool cannot serve their intended purpose, because without Internet connectivity it becomes impossible to share teaching and learning information across the globe at any time of the day.

Accordingly, Bhalla (2013:174) contended, "Developing countries have a responsibility not merely to provide computers for schools, but also to foster a habit of infusing a variety of ways in which computers can be integrated in teaching-learning amongst the end users of these tools". In a study combining both qualitative and quantitative paradigms in South African schools, Padayachee (2017:1) found that teachers are still uncertain as to the extent to which e-Education could be effectively enforced in teaching and learning while impeded by poor infrastructure and lack of relevant knowledge and skills on how to use computers as a tool in teaching and learning. These latest findings could signify that the use of computers as a tool was still in its infant stages in South African schools by the year 2017, because of teachers' failure to understand and implement the e-Education policy.

Tartarashvilli (2017) carried out qualitative research in Georgia on perceptions on integration of ICT tools in education, and concluded that the technical design of a tool does not signify its effectiveness in teaching and learning; effectiveness is accomplished when a computer tool is pedagogically used by knowledgeable educators who are supported in all facets of technological integration.

Using a comparative survey methodology, Blignaut, Els and Howie (2010:555) carried out a study involving 22 education systems, to ascertain levels of South African teachers' use of computer technology in teaching and learning as well as their

infrastructure, equipment and facilities. Blignaut et al. (2010:567) “South Africa’s inability to cross the boundaries of traditional learning towards the development of 21st century teaching and learning skills in the information age inhibits social and economic growth for the development of human capital.” Similarly, Padayachee (2017) found that there were serious discrepancies in relation to learners’ expectations of the information age, which thenceforth needed to be strategically resolved by e-education policies. Generally, the foregoing revelations could mean that levels of computer usage in South African schools is still very low, which should be a cause for concern to policymakers. In view of these findings, the researcher believes that, because human capital is at the centre of any nation’s development, it is incumbent upon the South African government to ensure a wholesome dispensation of quality education that is relevant to world current affairs.

The South African government, through the Department of Basic Education is in fact making tangible progress in making sure that digital resources, such as computer technology and its compatible software, are equitably distributed to enhance education delivery throughout the country (Ndlovu & Lawrence, 2012; Vandeyar, 2013). The same authors assert that the initiatives by the Department are evident in its ICT education policy, the product of White Paper 7 of 2004 on e-Education, as it attempts to outline clearer teacher education training guidelines on how computers could be integrated as part of teachers’ professional training repertoire. The major reason for embarking on such initiatives was to provide computer resources, especially in the previously disadvantaged schools in which dismal failures manifested in *key* subjects like mathematics and the sciences. The underlying assumption for government to undertake this action could be that the distribution and use of computers could automatically mitigate the failure rate in disadvantaged schools. Nevertheless, this effort is biased towards certain subjects at the expense of others that make up the secondary school curricula thus compromising the effectiveness of computers as a tool in teaching and learning in secondary schools.

According to findings (Pan African Research Agenda, 2008-2011), cited by Ndlovu and Lawrence (2012), teachers in disadvantaged and under resourced schools, where computer resources were provided, took little advantage of the government’s sterling initiative in trying to promote authentic teaching and learning (Ndlovu &

Lawrence, 2012:1). From the same source findings revealed that teachers instead used computers merely to transmit their content knowledge. This may have meant that teachers simply used computers to support their traditional teacher-centred teaching tactics, which brought no meaningful change in the learning process, as was originally intended by the government. Initially, the government was that teachers integrate computer technology into their teaching in accordance with 21st century world market requirements (Nlovu & Lawrence, 2012). In this regard, the researcher felt that the government formulated its e-education policies without taking cognisance of the knowledge and skills base of the implementers (teachers) hence intended benefits were inevitably not realized.

Likewise, Shulman (1987), as cited by Ndlovu and Lawrence (2012:11), emphasized that for teachers to meaningfully engage with their learners for authentic academic performance it is of utmost importance that computers as a tool should not be introduced in isolation, but in clear alignment with content and pedagogical knowledge. According to Ndlovu and Lawrence (2012), the quality use of computers depends largely upon how capable the teacher is in effectively teaching with or without computers as a tool. Blurton (1999:43) remarked that a computer is just a neutral tool, which means human choices and proficiency determine how effectively and efficiently it should work, and whether its revolutionary role will benefit humanity. This could simply mean that the teacher needs to charismatically mesh technological, pedagogical and content knowledge (TPCK) with sound knowledge of the crop of learners being taught, and a better understanding of the schooling context in which teachers operate. Knowledge of the foregoing factors (TPCK) allows the teachers to confidently to teach thus enhancing learner academic performance in this 21st century era.

Ndlovu and Lawrence (2012:21) have observed that:

> Recent studies in South African schools … present evidence that shows quality ICT usage is in small and insignificant patches which should be a cause for concern for a country that values quality and equity. More research is needed … to find out if it enhances learning, particularly in disadvantaged schools where quality is lacking due to inadequacy in both human and physical resources.

In agreeing with these authors' perspectives, the researcher strongly urges that much more research be undertaken on the extent to which computers as a tool could bring about quality education outcomes, so that the right strategies and direction can be adopted and followed in implementing government technological strategies for better learner performance.

In the light of the above review, the researcher proposes that for the effective entrenchment of computers as a tool in teaching and learning in secondary schools there is need for a participatory approach, involving all educational stakeholders, in formulating and ultimately implementing 21st century policies on technology. This strategy entails that the Department of Basic Education becomes proactive and always have contingent measures and plans ready in case of changes that may occur within the environmental suprasystems and subsystems of this dynamic, competitive world. Teachers need to become lifelong learners so as to be equipped with current pedagogical knowledge that corresponds with ever-changing technological trends, which may allow them to confidently teach for better learner academic performance.

2.4.1 The South African e-Education policy and schooling context

The e-Education policy was introduced with the aim of improving the way teachers teach and learners learn, thus enhancing revolutionisation of the South African education system (Department of Education, 2004; Vandeyar, 2013; Vandeyar, 2015). In correspondence, Isaacs (2007:8) wrote, in a survey of ICT and education in Africa (the South Africa report): "The goal of the policy is that every learner in primary and secondary school sectors should be ICT capable by 2013". The assumption was that by the said year schools would operate with computer literate School Management Teams (SMTs), and teachers capable of accessing computer tools that support the curriculum for ultimate learner academic performance. "Many countries become desolate without use of ICT, while others who use it daily have become power blocks", asserted Adu and Galloway (2015:242) in their scrutiny of South African national policy documents on ICT for education. The same authors stated that information is power, which is sought through meaningful use of computers in enhancing education and delivering content knowledge.

Isaacs (2007) asserted that computers empower teachers and learners in such a way that a paradigm becomes a glaringly conspicuous movement from an educator-dominated to a learner-centred approach, which is believed to promote that learners become more motivated and keen to construct their own knowledge through challenging and exciting learning programmes available through using a computer. Using computers exposes learners to opportunities for development of problem-solving abilities, creativity, independent and critical thinking, and collaborative activities. The problematic question could be that of the perspective, outlook and attitude as well as level of computer efficacy of the policy implementers (teachers) to enhance authentic learner academic achievement in secondary schools

Despite all the advantages of using a computer in teaching and learning, alluded to by the above authors, it is unequivocally noted that there is still very scant information to support such use (Isaacs, 2007), which shows that there is dire need to produce more detailed research on use of computers as a tool in teaching and learning in secondary schools across the curricula so as to come up with a clearer picture on the extent to which computers contribute to learner achievement. Lack of evaluation on computer use was revealed by Odera (2002) when she investigated how computers were used in secondary schools in Kenya. She used a mixed-method paradigm to elicit qualitative and quantitative data from educational stakeholders through questionnaires and interviews. She found out that there was a serious problem of lack of evaluative projects done to ascertain the effectiveness of computers in teaching and learning. To aggravate the problem her research revealed that there was no evidence of circulation and implementation of the computer policy, although it was established that the policy was formulated. The researcher strongly feels that, although this revelation was old, without profound evaluative information of computer policy implementation the extent of effectiveness of computers in schools will not be established.

The National Integrated White Paper (Department of Basic Education, 2016:3) outlines the policy framework issues of the South African government for transformation of the country into an inclusive and innovative digital and knowledge society, where specific issues like policies to protect the open Internet, and on inclusive digital transformation across the country are covered. Referring to the

importance of the internet, in the context of this White Paper (DBE, 2016:48), the Minister of Telecommunications and Postal Services, Dr. Siyabonga Cwele declared:

> ICTs are the single most powerful tools we have to transform South Africa into a prosperous developed nation where poverty, inequality and unemployment are not an everyday reality. ... The question that all of you … should be asking should be how best can you be part of this digital revolution.

By virtue of this demand the government is dedicated to work with the private sector, civil society and international organizations to live up to the full principles of a fair and open Internet. Such pronounced government effort clearly shows how committed the government is to ensure equitable use of this computer tool for the improvement of our education systems. It calls for a concerted and coordinated effort to ensure effective implementation of such important policy.

Using a qualitative paradigm through observation, interviews and document analysis, a case study design was employed to solicit data to explore the extent to which teachers used computers to influence educational improvements in South Africa (Vandeyar, 2013). Contrastingly, through that case study it was found out that e-education policy existed "invisibly", with no stakeholder support coupled with conflicting ideas of establishing collaborative support (Vandeyar, 2013:1). Furthermore, Vandeyar (2013:1) stated, "teachers' beliefs, attitudes and agency promoted ICT practice as a policy." Vandeyar asserted that teacher involvement in computer policy formulation could enhance meaningful implementation of the advocated policy.

The researcher concurs with Vandeyar because through PLCs and adoption of a participatory approach by policymakers, teachers could share the same platform and make successful use of computers in school. According to theories of policy studies in education, application of the Group Theory model could go a long way in ensuring effective computer policy implementation. The Group theory model proposes that interaction among pressure groups and teacher unions with policymakers promotes that some power balance in policymaking and in its ultimate implementation stages

(World Bank, 1988). All stakeholders, in this instance, feel total ownership of the policy product hence there is assurance of its success, especially in its implementation

Emphasizing the importance of the role played by a supportive community in the United States of America, Hirsh (2016:33) asserts, “Good teaching can often depend more reliably on the coherence of the wider system, and the cooperation it brings, than on virtual performances.” This could therefore imply that interconnectedness and collaboration amongst teachers, School Management Teams (SMTs) and the community could translate into efficient use of computer tools in teaching and learning in our secondary schools. Hirsh (2016:33) adds: “If I were a principal … I’d spend money on teachers, on their ongoing development … creating conditions in which work of teachers in one grade supports the work of teachers in the next, and in which teachers would have time to consult and collaboratively plan.” A healthy school climate, characterised by cooperation and collaboration by stakeholders, results in nothing other than excellent use of computer tools, culminating in excellent teaching and eventually good learner results.

Research carried out so far indicates that policymakers are ‘failing’ to meaningfully communicate e-Education and e-Learning policy intents to implementers (teachers) to enhance effective teaching and learning (Isaacs, 2007; Kozma, 2010; Kalas, Bannayan, Conery, Laurillard, Lim, Musgrave, Semenov, &Turchsanyi-Szabo,2012; Ndlovu & Lawrence, 2012;Vandeyar,2013; Kozma, n.d). Therefore, this confusion could be a symptom that somehow makes it rather difficult to measure the extent to which computers could be meaningfully used in the teaching and learning process. Nevertheless, the researcher perceives computers as a tool are as good as the teacher who uses them. A teacher who is pedagogically sound can most likely envisage better technological application to promote positive teaching and learner performance.

Ineffective use of computers in teaching and learning of maths seems to be attributed to insufficient confidence on the part of teachers (Leendertz, Blignaut, Nieuwoudt, Els, & Ellis, 2013). Therefore, an increase in confidence may mean teachers can be

committed to embracing computer technology to enhance learner achievement in maths.

Generally, the South African government's support of the computer policy manifests through infrastructure and connectivity provision, investment in computer use and creation of a conducive environment for its successful implementation through enactment of e-education White Paper of 2004 (Department of Education, 2004). This policy information inadvertently also addresses the kind of classroom support and guidance that is available to teachers to facilitate the use of computers as a tool in teaching and learning. The policy, more specifically White Paper 7, explicitly stipulates benefits that computers can bring to enhance effectiveness in the education fraternity (Department of Education, 2004:22; Wilson-Strydom & Thomson, n.d.), coupled with comprehensive and meaningful teacher computer efficacy training support. The government goes further to ascertain the effectiveness of its initiatives by encouraging research and computer project evaluation along the lines of computer use policy formulation so as to guarantee better future implementation of the policy. The researcher fully supports the idea of follow-up evaluation projects because it is only through such endeavours that a clearer picture of dividends acquired from government efforts can be established.

Evaluations carried out so far, however, reveal a lack of learners' and teachers' access to computers in schools, which aggravates IT applicability by learners at home and other training environments. The African Development Bank & Partners (2011:29) conclusively pointed out that evaluation of South African ICT policy implementation for teaching and learning indicated that, although e-education policy creates a robust environment for computer use, its rollout was not as sufficient as was initially planned. Therefore, the government advocates promotion of compatible situation and ongoing reviewing of other national portals like Thutong so as to be kept informed of the latest developments and changes in education in the global village.

Ndlovu and Lawrence (2012) note that the government's rollout programmes of integration of computers as a tool, with a bias towards disadvantaged schools, were embarked on with a view to mitigating the poor passes in maths and sciences, thus promoting equity and quality. The South African government assumed that dismal

failure in maths and science in these schools was due to limited resources; hence they thought such a predicament could be ameliorated if computer technology was equitably supplied (Ndlovu & Lawrence, 2012). To strengthen its computer policy for improving the academic performance of disadvantaged rural schools, South Africa recently signed a memorandum of understanding on an inclusivity approach on cooperation in the use of ICT with Namibia (SABC Network, 15 September 2017). Talking about the importance of cooperation amongst countries in use of computer tools such as the internet, the Namibian Minister of Technology alluded to the fact that rural dwellers can access research information in education easily, hence there is no need to travel long distances looking for current information.

"The ICT in education policy (DoE, 2004) advocates the pedagogical integration … that promotes higher-order thinking skills", which was asserted by Ndlovu and Lawrence (2012:1). The same authors also observed that those endeavours yielded negligible positive changes as teachers in the targeted schools possessed very little pedagogical knowledge on how to take advantage of computers for effective learner achievement. Therefore, this was a clear misdirected effort since, from the findings of these authors, teachers in these delineated areas proved not proficient enough to use computers to enhance effective teaching and learning. This is a clear manifestation of the disjuncture between policy and practice, a sign of lack of coordination between policymakers and people on the ground, in this case teachers who are the actual implementers of the e-education policies. The researcher, therefore, contends that for a policy to bear its intended outcome it should spell out a comprehensive plan on how pedagogical, technological and content domains (PTC) could be meshed so as not to interfere with standardized assessment prerequisites.

Based on the findings from Ndlovu and Lawrence (2012), the researcher strongly feels that, however good the government's IT policy is, its implementation will not be significant enough if teachers are not involved in the formulation of computer policies. Failure to have teacher representation creates a gap between what policymakers intend to achieve, and the abilities, perceptions and attitudes of implementers. Effective two-way communication between teachers (implementers) and policymakers allows for relevant crafting and better implementation of computer

policies in schools. The researcher therefore holds that a holistic approach be adopted embracing the TPCK approach in computer policymaking and implementation. A good teacher should dominate technological, pedagogical and content knowledge domains for authentic learning and academic achievement.

In concurrence with the idea of teacher involvement in computer policies and capacitation in Norway, Kalas et al. (2012) proposed that involvement of all stakeholders, especially teachers, could promote relevant use of computers in teaching and learning for learners' academic achievement. In contrast, the South African research carried out on computer use reflects very little quality and equitable use, which is a cause for concern to policymakers (Ndlovu & Lawrence, 2012). The foregoing authors comment that the problematic issue about little use of computer technology in teaching and learning stimulates further investigation so as to get authentic information on whether it really enhances learning, especially in previously disadvantaged secondary and rural schools. Nevertheless, it was established in the USA's Status of Technology in Schools Policy Information Report that computers promote authentic learner standardized achievement if they are used effectively and efficiently in teaching and learning (Coley, n.d.). The USA has a totally different, advance socio-cultural and economic background to that of South Africa. Irrespective of the country's economic status, with a relevant pedagogical approach meshed with relevant educational technology and corresponding software, computers can inevitably play a vital role.

The researcher therefore strongly believes, unequivocally, that without enthusiastic, knowledgeable teachers computers will not have any meaningful impact. Referring to the use of computers as a tool to strike a balance in equity and equality in disadvantaged schools, Ndlovu and Lawrence (2012:20) declared:

> The tool on its own, no matter what it is or how many of it we have in a classroom or computer laboratory cannot enhance learning on its own.… [It] takes human effort (teachers) to utilize it in a way that will help achieve the goals.

The researcher therefore opines that effective communication amongst educational stakeholders, teachers in IT development, capacitation and support could result in realistic implementation of a policy of using computers as a pedagogical tool, which may enhance effective and efficient use of the tool, culminating in authentic teaching and learning.

Seventy-five studies carried out in the USA established that learners who used computers in mathematics, social sciences and natural sciences scored higher marks than equivalent control groups (Kozma, 2008). Kozma highlighted that similar studies carried using 100 schools in Vadadora in India found that in schools where teachers were trained, provided with relevant software and used computers, students scored higher marks than in those where teachers were not capacitated, and not given software. This part of the literature review clearly shows that proper teacher support pays dividends.

This discovery was also made in Finland (Llomak, 2008). “Finland has a strong National Policy commitment to supporting the emerging use of ICT, and various administrations from the Ministry of Education to municipal organizations have created projects for promoting the use of ICT in education” (Llomak, 2008:18). Finland’s computer policy reflects total support for implementing IT to enhance comprehensive educational transformation and innovation.

The researcher strongly feels that what all South African policymakers need, henceforth, is to have follow-up evaluative projects to ascertain the extent to which its e-education policy is bringing about change in teaching and learning, especially in disadvantaged rural schools. Findings from studies carried out in the USA, India and Finland (Llomak 2008; 2010) conclude that there are a number of factors that intervene in the positive use of computers, such as coordinated policymaking, implementation and evaluation, teacher training and supply of relevant hardware and software for use in teaching and learning. However, these studies indicate a gap as the research seems to be skewed towards mathematics and sciences.

Kozma (2008) found out that time, and socio-cultural and economic changes contribute to the extent to which computers are used. For example, in the 1980s the

USA focused on drill, practice and tutorials, but with the passage of time as the networking and speed of computers changed, computers were being used for visualization, simulations, web-based research and collaboration and communication. Thus keeping abreast of technological changes inevitably culminates in positive and efficient use of computers to enhance teaching and learning. As Kozma (2010:1) writes, “Coordinating the use of computers with national policies and programs related to changes in the curriculum, pedagogy, assessment, and teacher training is likely to result in widespread use and learning.”

The World Bank (1998:31) stated that e-education policy implementation is difficult, expensive and complex, which necessitates taking cognisance of a host of issues such as infrastructure, curricula changes, teacher training, technical support, and material and moral support. Hence it calls for careful and insightful planning on the part of the Department of Basic Education. Emphasizing the importance of meaningful planning, in its report on “Latin America and the Caribbean: Education and Technology at the Crossroads”, the World Bank (1998) reflected that, irrespective of their countries being developed or developing, many governments were still seen to be on the threshold of the 21st century, in terms of e-education policy implementation, owing to lack of careful strategic plans. In this regard, the researcher concludes that well-coordinated and planned formulation of e-Education policies entail their meaningful implementation, as the policies would be owned and understood by all stakeholders in education, which above all should include teachers. When the route to educational objectives is clear, teachers are pedagogically trained in such a way that they assume the position of coaches, and learners benefit from being more active participants in knowledge construction.

The researcher strongly concurs with Kozma that if the aspects of coordination, time, and ongoing changes the world over are not taken into cognisance by policymakers, the computer policymaking process will end up being a futile exercise. Providing computers in secondary schools without proper coordination may serve no other purpose than showcasing to attract more students. Nevertheless, as has been mentioned, the Department of Basic Education has made some efforts to ensure the proper use of computers as a tool in teaching and learning, manifested through its ICT education policy formulation, White Paper 7 of 2006 on e-education, and its

teacher education training guidelines on how computers could be integrated as part of teacher professional training. However, such endeavours need to be translated into practice by proper departmental coordination of the implementation process.

2.5 CHALLENGES OF COMPUTER USE AS A TOOL IN TEACHING AND LEARNING IN SCHOOLS

As has been mentioned, the use of computers as a tool is commonplace in teaching and learning the world over as it promotes the accomplishment of better economic development, which depends on a high degree of knowledge and skills. Information about technological developments and how best computer technology could be pedagogically used in teaching and learning needs to be unveiled to teachers if meaningful use of computers as a tool is to be realized. Balmeo, Nimo, Pagal, Puga, ArisDafQuino and Sanwem (2014) assert that computers enhance the realization of a paradigm shift in teaching from teacher-centred to learner-centred strategies which correspond to 21st century educational requirements. Unfortunately, many problems prevent computers being put to maximum use (Balmeo et al., 2014; Alkathani, 2017) every day in secondary schools.

Most authors seem to concur in identifying two of the main problems that hinder meaningful use of computers in teaching and learning. These include a lack of knowledge about computers and their potential as teaching and learning tools on the part of teachers and learners, and a lack of carefully developed plans for successfully implementing e-Education policies and the use of computers across the curriculum (Paul, 1999; Kalas et al, 2012; Vandeyar, 2013; Ndawi, Thomas & Nyaruwata, 2013; Vandeyar, 2015; Helleve & Almas, 2017; Mwanda, Mwanda, Midigo & Maundu, 2017; Ngeze,2017; Padayachee, 2017; Saxena, 2017). Accordingly, in a study whose purpose was to obtain snapshot views of both the current and the prospective use of ICTs in teaching and learning in South Africa, Padayachee (2017:57) affirms: “The challenge not only lies with how to use technology but also with how to integrate digital technologies effectively into the curriculum.” Likewise, Mooketsi and Chigona (2014), as cited by Padayachee (2017:36), reveal that there is a gap between expectations and teacher practices in the use of computers in teaching.

Equally, Mwanda et al. (2017:165), in their study to find out the extent of computer integration into teaching and learning biology in secondary schools in Rachuonyo South Sub-county in Kenya, through questionnaires and observation, teachers revealed that they had inadequate training on computers, thus hindering their proper application to enhance real learner performance. Unfortunately, this is also a barrier that impedes meaningful use of computer technology in our schools. However, this study was limited to biological studies, which makes generalizing of its findings across all secondary school syllabuses very problematic.

In the light of these findings, the researcher feels that proper teacher training coupled with meaningful support in terms of IT pedagogic praxis, is vital if the real potential of computers as a tool is to be realized in South African secondary schools. Teachers struggle to use computers properly because of lack of direction and knowledge on how they could be integrated effectively in teaching and learning. Similarly, the study carried out by Ndlovu and Lawrence (2012), whose purpose was to investigate how mathematics teachers integrate computers in teaching, revealed that most South African teachers do not use computers in teaching mathematics because they lack relevant knowledge and skills to meaningfully integrate this tool. However, this study is as skewed as the one carried out by Mwanda et al. (2017), because it concentrated on mathematics, which signified a gap that necessitates more profound and integrated studies across the whole secondary school curriculum.

The central reason could be that the Department of Basic Education does not attend to the IT programmes mandate, a failing which is aggravated by the lack of incentives to continue after completion. Similarly, in a study conducted to ascertain challenges facing ICT integration in Saudi Arabian secondary schools. Alkatani (2017) reveals that the lack of training and working equipment impeded meaningful use of computers for better learner academic achievements. Saxena (2017) points out that computers fail to serve a meaningful purpose if teachers are not sure about the extent to which they can use them, a problem worsened by teachers' resistance and fear of the unknown. Therefore, the researcher posits that proper teacher support, in terms of training, is needed throughout to enhance good teaching and eventual learner success. This realization covered objectives 1 and 2 of this study, which studied

challenges with respect to how learners and teachers were impeded as they tried to use computers in teaching and learning.

Teachers' fears that they could be replaced by computers in their classrooms constitute one of the major barriers to successful use of computers in instruction (Balmeo et al., 2014; Tartarashvilli, 2017). This barrier could mean less application of the computer as a tool for effective teaching and learning. Nonetheless such archaic and absurd fears could be allayed by educating teachers and introducing technological changes in such a way that they see computers as merely educational tools that are only valid when used by knowledgeable and skilled personnel. Salehi and Salehi (2012),in their study, whose purpose was to explore high school teachers' perceptions of problems in using ICT in Iranian schools, indicate that teachers ineffectively apply technology in teaching and learning because they fail to keep up with current technological developments, and do not know how efficiently this tool could be used.

Deaney, Ruthven and Hennessy (2003:18), in their study explored learners' views on using ICT in teaching and learning in English secondary schools, stated:

> Pupils … were concerned about the extent to which, in future, teaching might become devolved from classroom settings by the adoption of more remote, digitally-based modes of delivery. They signified how work on technology-based tasks often resulted in reduced interactions with their teachers … and how 'norms' of classroom society were altered when pupils with good technical skills became expert advisers – to teacher and peers alike.

Conversely, the researcher feels that a teacher who adopts the TPCK approach would always be found prepared to learn with his/her learners in such a way that their grip or purpose as teachers would never be lost.

The teacher's working knowledge and skills about effective use of computer tools in teaching and learning is paramount in any educational setting in this 21st century. This can be realized if cautious planning and extensive teacher training on computer

use for instruction and student-learning are rolled out by education authorities. Teachers need to be conversant with the educational potential that computers provide so that they can embrace and begin using them effectively. The researcher affirms that it is only when teachers become comfortable and knowledgeable with the technology that learners will reap the intended benefits.

Another major challenge that studies revealed was lack of adequate computer equipment and corresponding educational software, which hindered effective and efficient use of this tool in teaching and learning (Wanjala, 2013; Ndawi, Thomas, & Nyaruwata, 2013; Mwanda et al., 2017; Alkatani, 2017). It is just frustrating to have no access to working computer equipment when a lesson has been planned to be delivered with the aid of computer tools. Even if teachers are skilled enough computers cannot yield expected outcomes if schools lack appropriate infrastructure and enough computer hardware and software.

Salehi and Salehi (2012) used descriptive analysis to investigate teachers' insights on challenges to using ICT in education. Through questionnaires, 30 high school English teachers from five main educational districts, in Isfahan, Iran constituted the sample of respondents of their quantitative research. The researchers' findings revealed that although they reflected zeal to use computers in the classroom, teachers encountered barriers such as lack of technological support at their schools, and little access to Internet & ICT facilities.

The other barrier that impeded teachers, in Iran, in using computers was lack of time (Salehi & Salehi, 2012). From the researcher's own observation and experience in the South African education system, educators are reluctant to lose time that is primarily allocated for curriculum coverage by the Department of Basic Education. The introduction of computers into South African secondary schools is not properly aligned with the curriculum and final assessments of the standardized external examinations. Since the education system is curriculum-oriented, teachers fear to be reprimanded by the subject advisers (who themselves are not aware of how to evaluate the use of computers in teaching and learning) for failing to cover the set goals of the curriculum on time. Consequently, teachers struggle to use computers because of curriculum volume, which does not specify when and how this tool could

be integrated. To worsen this situation, teachers are not obliged to use computers to strengthen their teaching, hence their use becomes infrequent.

Salehi and Salehi (2012) conclusively categorised the barriers into (a) teacher-level, which include lack of confidence, shortage of time and resistance to change; and (b) school-level, that is, lack of effective professional training in solving technological problems, and lack of access to resources.

Finally, studies reveal that a lack of knowledge and skills, as well as lack of adequate access to computer resources inhibits the use of computers as a tool in teaching and learning. These barriers are worsened by a lack of technical support and adequate computers in the classrooms. From the review of literature on the challenges, the researcher would classify the identified barriers into two categories namely:

(1) **Internal barriers,** which refer to teachers' attributes, attitudes, and beliefs. These constitute teachers' knowledge and skills that should be acquired through professional training in computer use; lack of confidence in how and when computers could be used in teaching and learning; resistance to change; fear of the unknown, that is whether the advent of computers into the educational arena could threaten their jobs; lack of intrinsic motivation to experiment in new pedagogical practices.

(2) **External barriers** would include lack of teachers' support; hardware limitations; lack of technical support; lack of collaboration amongst teachers; overcrowded classrooms; lack of time to efficiently and effectively use computers in teaching and learning; lack of incentives for teachers to take the initiative in acquiring computer training courses and using computers for teaching and learning; and last, but not least, the purchase of computers without exploring whether teachers are capable of using them effectively constitutes one of the major external barriers.

2.6 TOWARDS A NATIONAL STRATEGY SUPPORTING USE OF COMPUTERS IN SCHOOLS

It is vital that governments, in collaboration with other educational stakeholders and the private sector, cooperate in strategising how computers as teaching and learning tools could be authentically and efficiently used to ensure attainment of measurable excellence towards educational outputs and outcomes. Clear-cut strategic plans are needed on how integration of computers into the secondary school curriculum should be put in place to promote learners into becoming more active constructors of their own knowledge rather than being passive recipients of the education process.
In this regard, Noss and Pachler (1999), and Leach and Moon (2000), as cited by Deaney, Ruthven and Hennessy (2003:1) state that:

> …others see successful educational applications of the computer as involving a complex interplay of context, people, activities, machines, and available software within specific settings. While quality and level of … resource continues to improve in many schools, provision of equipment alone is likely to be of limited value unless more is understood about the interactions and processes engendered by using technology in different settings, and how pedagogical strategies to enhance students' learning might be developed effectively through them.

This sounds like a good strategy, that the Department of Basic Education could adopt, to ensure efficient and effective use of computers to enhance good learner performance and ultimately academic success. The researcher, therefore, feels that the TPCK approach is the best strategy to use if computers are to play a role in our secondary school curricula, as it provides an integrated approach.

Embarking on pilot evaluation projects concerning the implementation of computers as a tool in teaching and learning is a very important strategy before delving into the actual grand projects. Pilot projects allow discrepancies and daunting pitfalls to be avoided. Referring to strategic plans to engage in meaningful and fruitful computer technology integration in teaching and learning, Osin (n.d:10) asserts, "A risk that no

region should take is to rush into total regional coverage, with the large-scale introduction of computers into the educational system." On page 11 Osin goes further to postulate, "Each pilot project should include a carefully-designed formative evaluation, to discover the pitfalls to be avoided in the large-scale implementation, and in what measure the materials supplied by external sources satisfy the regional requirements." This is critical because the relevant pilot project(s) will be adopted and implemented taking cognisance of the relevant software, hardware, and courseware. Outcomes of the evaluation of pilot projects also provide the right direction that implementers should take into consideration in relation to the type of training teachers could be given to use computers in the classroom and outside.

Another strategy that South Africa put in place to ensure the effective use of computers in education was the enactment of comprehensive and broad policies on the use of computer technology at both national and provincial levels (DoE White Paper 7, 2004; Ndlovu & Lawrence, 2012). Above all the DBE is encouraging technology-enhanced learning research to be carried out so as to ascertain the degree of effectiveness of computers as a tool in teaching and learning. One more useful initiative that South Africa has taken is to engage in national and international conferences on the use of 21st Century technology in education, which serves as a good strategy that can promote meaningful e-education policymaking and implementation (DoE White Paper 7, 2006; Government Gazette, 2017).

Although e-strategies are in place, the major challenge manifests itself in a lack of knowledge and skills for successfully integrating computers in teaching and learning (Ndlovu & Lawrence, 2012; Mathevula, 2015; Saal, 2017; Mwanda et al., 2017). Referring to a good strategy for integrating computers in teaching and learning Edutopia (2014:5) asserts:

> When you're integrating technology, you want to make sure that it aligns with the learning goals and ultimately help students reach those goals…successful technology integration hinges upon a healthy balance of online time and offline time. When balanced well, students can achieve great things; stay focused, and moves forward to their ultimate goal.

Edutopia (2014) commends that technology has to be consistent and clear in supporting learning objectives. This strategy is in line with what the researcher mentioned that computer technology use should be in proper alignment with pedagogy and content so as not to lose sight of what learners have to ultimately achieve in correspondence with set standards and educational goals.

2.7 DEVELOPED AND DEVELOPING TRENDS IN THE USE OF COMPUTERS AND ITS RELEVANCE TO TEACHING AND LEARNING IN THEIR EDUCATIONAL SYSTEMS

Computers are seen to be taking centre stage, in developed and developing countries, in teaching and learning as well as for administration purposes. Remarkable shifts occur from simple to more complex uses of computers in teaching and learning. Computers were used for teaching simple skills in the 1970s, but now the trend has dramatically shifted to more complex uses of computers as a tool for experiential learning and to engage learners in more challenging problem-solving and collaborative projects (Fouts, 2000). In a study about computer use by school teachers in teaching and learning, Bhalla (2013:176) asserts:

> Over the past decade, technology has been used in a variety of ways and for an array of purposes. As new technologies have emerged they have often in time been replaced or have been used concurrently with earlier technologies, thus dramatically changing the nature of the way the technology has been used in the classrooms.

From Bhalla's findings, the researcher concluded that computers were initially used to solve simple tasks since in the past decade their use has evolved into more complex tasks and problem-solving assignments where learners collaborate in acquiring and constructing knowledge, which corresponds with current world requirement standards.

Blurton (1999), in the study whose purpose was to investigate new directions of ICT use in education, asserted that digital tools' contribution to effective and efficient teaching and learning was then seen to be dramatically growing worldwide. The same researcher went on to comment that these evolutionary changes seemed to encounter common challenges such as insignificant use of computers mainly due to lack of teacher training in the use and harnessing of computer tools. This trend was found to be common in both developed and developing countries, although it seemed to be more glaring in developing nations by virtue of their economies' always lagging behind those of the developed nations.

In reference to the importance of computers in both formal and informal education, Blurton intended to illuminate the then-current nature of their use. He found that older technologies were still being correlated with the latest technologies, which is evidenced by books being sold nowadays with CD-ROMs inside (Blurton, 1999:2). This was a very important revelation because information never becomes obsolete; instead, it may constitute a baseline background on which new computer technologies may be built for better problem-solving in pursuit of excellence in our education systems. Nonetheless, these findings seem to contradict part of the theory of connectivism where it says knowledge is fast-changing in such a way that what could be correct and applicable today could be regarded as obsolete sometime down the line.

From a comparative perspective, it appears that Blurton (1999), Fouts (2000), Pouris (2012) and Bhalla (2013) propounded similar trends in the evolution of computer technology as they all concur that it uses are always changing from simpler to more complex application in education. Furthermore, they postulate that simpler technologies are always used together with new ones, which are perceived to make teaching and learning more authentic, exciting and meaningful, thus promoting the development of student skills demanded in the current world of work. The researcher, from the aforementioned findings, feels that simpler and older technologies constitute the bedrock on which new computer technologies are anchored. Another similar established trend is that technological developments should develop alongside pedagogical developments of human capital, otherwise computer supplies, together with their relevant software in our secondary schools, would be futile as nobody would

be able to make use of them for teaching and learning. Just as Siemens asserted, in his theory of connectivism, that “the pipe is more important than what is in it”, more specifically in relation to lifelong-learning, teachers are always in a position to use the latest computer tools in their teaching, thus making current knowledge and skills superseded by those relevant for future socio-cultural and economic requirements.

2.8 COMMON WAYS COMPUTERS ARE USED IN TEACHING AND LEARNING

Computers are used for myriad purposes in education with the sole aim of achieving excellence in learners’ academic outcomes. Research studies by Balmeo, Nimo, Pagal, Puga, ArisDafQuino & Sanwen (2014) and Ngwu (2015) explain that they are used in a variety of ways: to prepare instructional material; keep administrative records; access and exchange model lesson plans; do research; and consolidate learnt material through drill and practice by learners. The researchers concur that computers play a pivotal role in the teaching and learning of 21st-century skills so that learners stay familiar with the knowledge and skills demanded in the current competitive world of work. Computers in secondary schools are used as research, problem-solving, creative and presentation tools (Gudza, 2010). Hoffman (1996:92) noted that learners benefit a lot when they tap massively essential and relevant information from the World-Wide Web (WWW), and from a wide variety of CD ROMs like Encarta and Grolier 1999.

The researcher, however, feels that using computers cannot be considered a panacea for educational limitations; hence their effectiveness calls for teachers’ sound pedagogical background. Nevertheless, effective and efficient use of computers entails that learning becomes a process for constructing knowledge rather than merely passively acquiring it. Farmery (2014:27), in referring to the use of computers in teaching and learning, asserts that it should be viewed from the standpoint of supporting theories of learning. In this subtopic, Farmery has expatiated on common computer uses revealed in the literature consulted. Computer use in school is characterised by teacher-controlled use, which includes forced adherence to timetables, whereas at home learners use them more for social and communication purposes with no fixed timeframes. In concurrence Farmery (2014:

41) posits that at-home learners use the internet for communication, information seeking, entertainment, and other collaborative projects without a teacher's strict supervision.

Bhalla (2013), in her comprehensive study about computer use by Indian school-teachers, asserted that in teaching and learning computers are generally used in a variety of ways namely in computer-aided learning (CAL), computer-assisted instruction (CAI), and computer-managed instruction (CMI). In her study she concluded that any form of application of computers for instruction can be categorized as computer-based instruction (CBI), which refers to the use of computers in both instruction and the teaching/learning process – that is CAL, CAI, and CMI.

2.8.1 Computer-aided learning (CAL)

CAL is a computer tool that is used to pedagogically help or complement teaching and learning to enhance learners' academic achievement. Bhalla (2013:177) states that it can be used together with other teaching tactics and aids such as lectures, data projectors, textbooks, and worksheets. Zupanec, Miljanovic, and Pribicevic (2013:423) define CAL as an "educational method which uses computers as an environment in which the learning period becomes shorter and enhances learner motivation, and can be useful for pupils because of their different learning speeds." Explaining the advantages of using CAL, Zupanec et al. (2013:423) state that "pupils are led by the strategy of small (short) steps, i.e. … step-by-step strategy, being directly informed about their own progress and with the teacher's adjustment to every pupil." Zupanec et al. (2013) and Bhalla (2013) concur that the use of CAL promotes independent individualized learning adjusted to suit each learner's pace.

CAL's advantages become conspicuous as learners become more responsible for their own learning, which takes place at any individual suitable time, pace and place. These researchers assert that CAL keeps learners engaged in relevant given tasks because of its visual animations coupled with sound and color. It has the advantage of allowing immediate feedback, which timeously promotes relevant learner acquisition of knowledge, and gets rid of previous mistakes (Zupanec et al., 2013).

Experience has proved that immediate feedback makes learners become more motivated and keen to learn more and improve on their mistakes. The researcher, therefore, is strongly tempted to conclude that this approach conspicuously supports the theory of constructivism as its application gives learners room to experiment thus allowing them space and time to be more active and learn through mistakes. The researcher strongly feels that the use of CAL can go a long way in improving learning and promoting ultimate academic success in secondary school. The literature reviewed makes clear that rote learning is minimised with the use of CAL (Zupanec et al. 2013).

This CAL model appears to be somehow similar to CAI. The researcher takes this view because Zupanec et al. seem to use the two approaches interchangeably. They contend that the use of Individualized computer-assisted instruction (ICAI) and cooperative computer-assisted instruction (CCAI) play a more significant role in learner achievement than Conventional Instruction (CI). They observe that a CCAI group of learners, in a survey, scored better marks than the ICAI group. The researcher, therefore, concludes that CAL or CAI, when used in situations where learners collaborate, can result in more significant learner achievement than merely use of ICAI because CCAI promotes cross-pollination of ideas and opinions amongst learners. The researcher accordingly urges that group work should be nurtured in our schools, using suitable pedagogical approaches, to help learners do well in their studies. Intelligently learner-formed and guided groups enhance learner performance as learning discrepancies and pitfalls are group-identified and collaboratively resolved. Because the CAL approach combines simulations, sound and visualisations it proves a better tactic than traditional teaching strategies, which are merely teacher-centered.

Zupanec et al. (2013) however, found that CAL is inadequately applied in the teaching and learning of biology in Turkey, where there is a lack of research information on how it should be properly used, and a lack of support in terms of computer equipment, software, and teachers' computer competence. These findings are biased towards the teaching of one biology topic in Turkey, leaving out the rest of the curricula.

Nevertheless, it is clear that the use of the CAL model in teaching can significantly increase learners' knowledge and reasoning skill and their application more than the traditional approaches of content teaching. Zupanec et al. (2013:440) conclude:

> Such a model of work requires an increased activity of the teacher who plans, prepares, and constructs educational software as well as organizes the work of pupils, aware of the fact that despite many advantages of CAL, it is not the only good solution, and that it should be used when there is a belief that it is the best teaching-method strategy for learning about biological phenomena.

Kumari and D'Souza (2016) assert that for learners to succeed it is imperative that teachers be computer literate so as to guide learners to use computer technology to their learning advantage. Kumari and D'Souza (2016:141) say that "there exists a positive relationship between digital literacy and ICT use of teachers in rural and urban schools." The researcher strongly agrees that there is an objective correlation between the use of computers and the enhancement of learning in secondary schools.

The researcher also strongly believes that computers may remain small white elephants in secondary schools if teachers and learners do not put them to good use. CAL is not an infallible means to promote learners' total academic success. It calls for an enthusiastic, motivated and well-supported teacher, who is focused both pedagogically and content-wise. Use of CAL yields positive results if the teacher plans relevantly in accordance with teaching and learning objectives in correspondence with the Department of Basic Education's prescribed standards and norms.

The use of CAL has many advantages. CAL is a teaching approach that is multifaceted in nature, which motivates and caters to an individualized learning pace, providing, above all, current information, which makes the learning of something abstract more "tangible" and realistic. Bhalla (2013:177) summarizes the use of CAL: "This mode of instruction employs …three ways – whole class instruction; teacher-directed student assignments; teacher's self-learning". This explicitly stipulates that

a teacher can just reach out to the whole class even when using one computer, which ameliorates problems of not having enough computer equipment as was alluded to, above, by Mathevula (2014).

Problems brought about by the lack of sufficient computers can be significantly ameliorated by the CAL approach (Mdlongwa, 2012). The researcher is left with little or no doubt that the use of CAL promotes motivation and collaborative teaching/learning styles since the approach ensures that every learner is reached out at the same time. CAL promotes good consolidation as learners may go through presentations several times after normal tuition time, and allows that the teacher be kept abreast of the latest subject knowledge, because through the internet teachers surf for the latest information and can share TPCK with other professionals, defying distance and time constraints. Deaney, Ruthven, and Hennessy (2003) mention that the use of the internet promotes easier and collaborative seeking of information, thus enhancing teaching and learning across the curricula.

2.8.2 Computer managed instruction (CMI)

Another essential use of computers is CMI when a computer is used for classroom management requirements. Bhalla (2013:178) asserts that CMI is an "instructional strategy … used to provide learning objectives, learning resources, record keeping, progress tracking, assessment of learner performance, and prescribe and control individualized lessons." Bhalla says that learners may not necessarily have to be in contact with a computer, but can access tutorials online where the computer can diagnose their specific needs, and craft optional sequences of instruction. The researcher, therefore, concludes that CMI is so user-friendly that learners benefit better than when merely subjected to traditional teaching and learning styles. Bhalla (2013:178) says:

> This mode of instruction employs the use of computers in the management of adjunct functions or instruction-related tasks such as material generation, lesson plan preparation, schedule preparation, attendance monitoring, student's performance assessment, individualized education plan preparation … communication.

She explains that CMI assists teachers in generating material, developing lesson plans, disseminating school E-circulars such as announcements, and homework communication with learners, parents and other peer professionals. The researcher perceives, from the foregoing, that CMI is used for a variety of purposes such as assessment, which encompasses measurement and evaluation of generating information on which diagnosis-remediation is done so as to identify strengths and weaknesses of learners. In view of the importance of CMI, he researcher strongly feels that it is vital for secondary school teachers to imbibe CMI in the teaching fraternity as this makes the teacher's work much more interesting in reflecting clear past, present and future teaching activities. The use of the CMI approach promotes that the teacher has a clearer picture of curriculum coverage, which may mean better final performance of learners in secondary school examinations.

Despite the advantages of CMI described above, its use may result in unnecessary time-wasting if teachers' attitude is critical, and they are unsure of how they should use it to the learners' advantage. To realize the significant potential of computers as a tool, teachers need to be trained in their use (Joiner, Miller & Silverstein 1980; Agbo, 2015). Stankov (1996) asserts that CMI involves teacher-centered interaction and interaction between a computer and other teaching tools. This, therefore, may mean that CMI is a teacher's product primarily designed and used to manage learners' progress. The strategy of making teachers knowledgeable was also found in a case study carried out in Norway (Helleve & Almas, 2017). The researcher feels that the participatory approach translates the use of CMI into a success because it becomes a model that is totally owned by both policymakers and the implementers (teachers) on the ground.

2.8.3 Computer-assisted instruction (CAI)

Lastly, research studies reveal that computers are used as teachers in what is called Computer-assisted instruction (CAI)(Joiner et al., 1980; Stankov, 1996; Bhalla, 2013; Zupanec et al., 2013; Ngwu, 2015).Giving an example, Farmery (2014) explains that in CAI drill and practice software is used to enhance teacher presentation, thus supporting the behaviourist pedagogy. He says that CAI offers room for

individualizing instruction, thus moving from rigid and inflexible group instruction. Bhalla (2013) writes that CAI is a mode of instruction in which learners interact directly with programmed lessons and tasks. The role of the teacher is reduced to that of a coach or facilitator, promoting a learner-centred approach.

In her research, whose purpose was to explore the effects of CAI (e-learning) on secondary school students' interest in learning basic statistics, Ngwu (2015) used the following methodology: a non-equivalent quasi-experimental design with three secondary schools constituting the sample of schools. A purposive sampling method was used to choose schools by virtue of the fact that they had the right equipment under study. Two complete classes from each school were selected through a balloting process, amounting to six sampled classes. Research questions were designed for the experimental group to ascertain students'' interest in teaching and learning using the CAI teaching strategy. Findings revealed that the experimental group of learners taught with the e-learning method, CAI, showed a higher interest than the control group (Ngwu, 2015:1). The researcher is confident that CAI boosts students' interest more than conventional traditional teaching styles, which are teacher-centered. Therefore, the use of varying teaching approaches could be a better pedagogical approach that can guarantee better teaching and learning in our secondary schools, as this approach motivates learners to engage in challenging tasks collaboratively. Ngwu (2015), however, revealed that the use of CAI, irrespective of its vital role in students' learning, is still in its infancy in developing countries, of which South Africa is part. In contrast, CAI is now deeply entrenched, widely used, and found to be quite effective in developed countries like the USA. The researcher therefore strongly believes that more research of this kind should be encouraged amongst developing nations so that our young generations can compete in the global market.

In the Policy Information Report on the status of technology in American schools, Coley (n.d) reported that CAI is mostly used for drill and practice and was reported to be very effective in producing good achievement gains in students. The researcher therefore deduces that, just like CAL, this approach, depending on how it is used, does have the potential to support the constructivist theory, which promotes independent and critical thinking on the part of learners because the teacher plays

the role of facilitator, leaving learners much more active in their process of knowledge construction.

Nazimuddin (2015:186), a researcher in India, reports that through CAI quality and quantity are easily managed. For example, about 4000 learners can be attended to in just one lesson. CAI promotes individualization of learning and encourages timeous feedback, thus allowing the teacher to craft personalized remediation and future tutoring. Above all, CAI can be used for any type of teaching and learning programme in multifarious forms such as pictures, games, simulations and problem-solving. Zupanec et al. (2013) assert that the use of CAI promotes independent individualized learning adjusted to suit each learner's pace. The statistical outcome of the experiment carried out on the effectiveness of CAI use, as a model of teaching, in Serbia, reveals that learners' academic improvement and achievement manifest across the curriculum – that is, only if courseware is tailor-made to correspond with relevant content for intended summative outcomes of the Education Ministry (Zupanec et al., 2013; Ngwu, 2015). Nevertheless, the researcher still strongly believes that without a knowledgeable and enthusiastic teacher CAI cannot serve its intended purpose.

In view of the diverse characteristics of the CAI approach, the researcher is confident that this is a model of teaching which can promote authentic learning information that may include questions and immediate feedback and record keeping. CAI appeals to learner enthusiasm because it comes in a game-like manner encompassing simulations with drill-and-practice and problem-solving tactics. Therefore, it can be regarded as a holistic, wholesome approach to teaching which can promote learners' higher academic achievement.

Joiner et al. (1980) commented that the rationale given for CAI is that learners experience individualized and flexible instruction thus promoting that learning takes place at an individual pace. Stankov (1996:1) concurred:

> Computer-Assisted Instruction optimizes the process of learning … by individualization, modeling it according to the capabilities of a student. With the help of computers didactic and psychological requirements

> such as complete individualization of teaching, a creative attitude of a student towards learning can be achieved.

The researcher is therefore certain that the individualizing tendency of CAI constitutes a major advantage, because if used in conjunction with a group approach (CCAI) some individual learners may lag behind unnoticed by teachers, hence ultimately no meaningful general class achievement will be realized.

"Computer-Aided Instruction (CAI) is a diverse and rapidly expanding spectrum of computer technologies that assist the teaching and learning process," asserts Nazimuddin (2014:185). "It can store the organized information, it can process the information suiting to the needs of the individual learner. In short, CAI covers the entire educational system by proving itself in a useful tool in teaching various subjects." (Nazimuddin 2014:185).

Nonetheless, Zupanec et al. (2013) note that CAI plays a more significant role if it is used as a cooperative strategy, as cooperative computer-assisted instruction (CCAI). Concurring with Zupanec et al., Ngwu (2015:1) asserts that CAI brings learners and teachers together, thus promoting meaningful sharing of information resulting in effective and efficient teaching and learning.

Nevertheless, Ngwu and Nazimuddin warn that without proper support in the supply of relevant computer hardware and software, and teacher capacitating coupled with better teaching techniques, CAI may not encourage teaching and learning excellence. Kumari and D'Souza (2016:141) observe:

> Teachers are expected to provide learners with appropriate and contemporary experiences that allow them to successfully engage with digital technology and prepare them for 21st century skilled life after school.

Therefore, for such targets to be accomplished teachers need to be fully capacitated technologically, and supported by the school, community, and policymakers. The researcher recommends that computer literacy, in terms of how such approaches as

CAI work, be regarded as part and parcel of any teacher's professional repertoire if he or she is to deliver well in the 21st-century education system.

Despite all the foregoing advantages of CAI, research indicates that it has some glaring limitations as well (Joiner et al., 1980; Stankov, 1996; Bhalla, 2013; Zupanec et al., 2013; Ngwu, 2015; Nazimuddin, 2015; Kumari& D'Souza 2016; Helleve & Almas, 2017). Some of the limitations are that CAI "suffocates" learners since it prevents them from giving unanticipated answers. The CAI pre-specified answers leave it with no criteria for judging learners' responses other than right or wrong (Stankov, 1996:7). Stankov more or less tries to portray that CAI resembles a robot which only understands what is programmed, meaning failure of the CAI programme entails no meaningful teaching and learning. The researcher deduces from Stankov that CAI is a programmed kind of instruction method, which, because of the way it is configured, cannot be flexible enough to move out of the realm of "right or wrong" answers. Therefore, it goes beyond reasonable doubt that CAI only yields authentic results when used with the guidance of teachers who know how it works. Concurring with Stankov, Nazimuddin (2015) affirms that CAI becomes dehumanizing if it is poorly designed, which inevitably lowers learners' interest and motivation in wanting to learn more. Thus inadequate teacher knowledge in this respect means a disaster in the teaching and learning process.

The foregoing limitation was, to some degree, minimised by the designing of an Intelligent CAI (ICAI), which has multifarious functions in the problem solving area, answering what, whom and how questions. ICAI is synonymously known as intelligent tutoring systems (ITS), which give room for presentation of rich domain knowledge that is flexible enough to be used by a learner in a way which is not defined in advance by the teachers, or not in a predetermined way (Stankov, 1980:6). Stankov asserts that ICAI/ITS is flexible enough to take cognisance of learner abilities, weaknesses and preferred learning styles.

In contrast with all the above sterling improvements, ICAI/ITS is still very scarce on the market, hence its use is still confined to the elite (Stankov, 1980). This reference is too old to rely on. If this situation still stands then the researcher feels the gap should be closed through research so that we can make a cheaper and more

accessible ICAI/ITS available so as to help learners do well. Lack of profound research information on how computers as a tool can be effectively used in teaching and learning is a predicament wreaking havoc in the education systems of developing countries.

In concurrence with the above findings (Kozma (n.d:16) asserts, “To date, there is a dearth of research in developing countries on the school-level impact of ICT, and future research needs to address this deficiency.” There is scant research information on the use of computers, which is skewed towards “special” subjects like maths and sciences (Smith & Hardman, 2014). This is a serious gap, which happens to be the major problem identified, thus the need for the current research.

The researcher therefore concludes that good computer policies coupled with well-trained teachers in CMI and CAI can save on educational costs and help learners succeed. Developing nations have a responsibility to equip schools with computers, thereby fostering positive attitudes and habits towards their use to the advantage of learners (Mdlongwa, 2012; Bhalla, 2013; Dambudzo, 2014; Mathevula, 2014). Bhalla (2013:182) found that the majority of these (CAI,CAL and CMI) uses, in India, were spread towards updating subject knowledge or pedagogical skills, developing lesson plans, communicating with peers and learners, and preparing question banks and additional instructional material. The foregoing was reported by Smith and Hardman (2014). In this regard the researcher feels that CAI, CAL and CMI could be the main models for computers that are needed in developing and developed countries. Bhalla, however, noted that CAL is the most popular model for computers. The researcher agrees that the CAL approach promotes that all students are attended to at the same time and gives full control to learners using the internet. Another advantage is that it can update their work while the teacher teaches. Nevertheless, participation by all stakeholders in computer policies is a requirement if computers as a tool are to be used to improve teaching and learning. Teacher and learner support and the latter’s keenness to learn would encourage meaningful use of CAI, CAL and CMI.

2.9 THE ROLE OF TEACHERS IN USING COMPUTERS FOR INSTRUCTION

Teachers play a significant role in putting educational tools to efficient use. Without relevant teacher knowledge and skills computers cannot serve their intended purpose hence it is vital that teachers become conversant with what computers can and cannot do to enhance meaningful teaching and learning. Making reference to some authorities, the following is an exploration about what teachers perceive as prerequisites for effective use of computers in secondary schools.

2.9.1Teacher expectations: potentialities of the use of computers as a tool

The generality of researchers the world over believe that computers as a tool play a significant role in enhancing teaching and learning in secondary schools (Milkre, 2011; Mdlongwa, 2012; Mathevula & Uziweyimana, 2014; Brun & Hinostroza, 2014; Edutopia, 2014; Mathevula, 2015; Ngwu, 2015; Rabothata, 2017). Using a quantitative paradigm and structured questionnaires, Mathevula (2015) collected primary and secondary data from teacher respondents in secondary schools in Groot Letaba Circuit, Mopani District in Limpopo, whose purpose was to investigate the effects of ICT on teachers' ability to perform their duties. The findings established that teachers felt that computers have a negligible impact owing to scarcity of technological tools for teaching and managing curriculum. To aggravate the situation, teachers in the selected schools revealed that the computer training they received was hurriedly gone through and so shallow that the "crash" training culminated in less meaningful use of computers as a tool. It is logical that if teacher computer efficacy and confidence to integrate computer tools in teaching and learning is lacking, the process would be insignificant. However, the researcher felt that the findings are not generalizable to the whole of South Africa because the researcher used only the quantitative paradigm, which results in failing to capture real and profound feelings and perceptions of teachers

Teachers' experiences in Norway (Helleve & Almas, 2017) were similar to Mathevula's findings (2015) in South Africa, when the authors studied the importance of networked classrooms to enhance the teaching and learning process. Helleve and Almas's (2017) study revealed that computers have little significance if teachers are

little involved in computer policymaking and implementation. Based on open-ended questionnaires, involving a sample of 65 secondary school teachers, teachers' feelings and experiences indicated that they were seldom given a chance to express their opinions about the importance and effectiveness of using computers in teaching and learning by school management and departmental officials. The respondent teachers therefore could not see the pedagogical importance of computers if they were not consulted about their use. They, eventually, merely used computers for administration, and used them for teaching only after having made some adjustments to suit their old teaching practices. Government initiatives and effort were hardly taken advantage of, hence the researcher's opinion is that the DBE should start by capacitating teachers, and then introduce change if computer policy is to serve its intended purpose. Helleve and Almas concluded by asserting that minimal use of technology's interactive abilities eventually occurs in such scenarios.

Teachers' opinions are that without proper control and guidance, learners' attention, to central educational objectives, will be distracted; hence they do not use the technology during lectures (Helleve & Almas, 2017:4). Furthermore, the researchers reported that most teachers believe that the emphasis should be on the development of the pedagogical use of technology and possibilities for collaborative development activities among teachers and schools.

Teachers feel that it is a cumbersome issue to evaluate the extent to which computers impact on teaching and learning because educational technology is a dynamic entity (Coley, n.d.). The researcher strongly concurs with Coley because educational technology is just one dynamic component of teaching and learning, which is impacted upon by other factors such as learner backgrounds, and socio-political and religious environments. The researcher therefore contends that impetus for change in our schools comes through understanding and coordination of environmental suprasystems (technological, economic, legal, political, demographic, ecological and cultural factors) and from subsystems, which could include goals, values, technical, psychosocial and managerial aspects. This might be so complex that it calls for charismatic and transformational leadership styles that motivate teachers to welcome change and implement relevant technological changes to the advantage of authentic and relevant learner achievements. Because of this dynamic characteristic of

computer technology, it becomes hard to evaluate and integrate it, as what is applicable today will not be applicable tomorrow.

The foregoing is supported by what Siemens (2004) proposed in the theory of connectivism, that “the pipe is more important than what is in the pipe now”. What could be considered good computer educational software today could be obsolete a few years later. Therefore, teachers (Coley, n.d.) felt that it is very hard to be conclusive about effectiveness of computers, and thus their compatibility and applicability in teaching and learning.

Similarly, Llomaki (2008) carried out a study in Turku, Finland, whose purpose was to investigate teachers’ and learners’ perspectives on the effects of ICT on teaching and learning, which encompasses national educational policy on how ICT can be integrated into teaching to make it more effective. Unlike studies conducted by Mathevula (2015) in South Africa, Llomaki (2008) used a mixed- method approach to investigate this educational phenomenon. Qualitative and quantitative data were sought from three case studies. The author found out that teachers and students thought that the use of computers was good, both at school and at home, for teaching and learning.

Eristi, Kurt and Dindar (2012:39) carried out a study employing a qualitative research paradigm in Turkey (which is used by the current researcher), whose purpose was to determine teachers’ views and their suggestions about integrating computers into education. A sample of 21 teachers was selected purposively and their views and suggestions were elicited through use of focus group Interviews and observations. Using the thematic method of data analysis, the findings of the foregoing authorities were that learning that is supported with activities which address more than one sensory organ attract learners’ attention and interest, leading to permanent and meaningful learning. The researcher strongly concurs and supports use of this paradigm because it allows the researcher to investigate real feelings and attitudes of recipients of computer technology in teaching and learning.

In concurrence with the foregoing authorities, Ngwu (2015) asserted that varying teaching approaches promote learner motivation and keeps them engaged on given

challenging tasks, to their ultimate academic advantage. The researcher therefore strongly feels that computers be provided and used in our schools, across the curricula, coupled with necessary teacher and learner support if academic excellence is to be achieved. These scholars found that, because teachers are more than willing to use computers in teaching and learning, constant ongoing support for their use is obviously needed. Teachers however, pointed out that computers are only effective when their use complies with curriculum requirements, teachers' computer knowledge and skills, and appropriate plans that should be constantly in place. Unfortunately, such harmony is lacking in our secondary schools, resulting in computers not serving their intended purpose (Kahveci, Sahin & Genc, 2011; Eristi, Kurt & Dindar, 2012; Salehi & Salehi, 2012; Okorie & Agah, 2014; U.S. Department of Education, 2000, 2017) asserted that teachers cited their lack of time to plan and apply technology as an obstacle that inhibited effective computer use in teaching and learning.

Furthermore, it was found that the teachers used computers for various purposes, thus limiting their use for students. This suggests that there was no uniform guidance on how computers could be used effectively as a tool for learning. Kumari and D'Souza (2016:141) assert that to help learners succeed it is imperative that teachers be computer literate so as to guide learners to use computer tools to their advantage. Through the case study, Llomaki (2008) revealed that teachers received full support in acquiring skills and knowledge, up-to-date facilitation of collaborative learning communities. Llomaki established, from his study that the majority of teachers had "sufficient" computer skills.

Nevertheless, Llomaki found that most of the teachers could not apply computers as a tool in a meaningful manner (Llomaki, 2008, Helleve & Almas, 2017). The underlying assumption from the foregoing findings is that a good teacher can apply computers in instruction properly only if he or she knows pretty well where and how to do it. Therefore, technology, pedagogy and content knowledge (TPCK) are complementary components of education that are inseparable for better learner academic achievement. Unfortunately, teachers (Helleve & Almas, 2017) said there were no clear-cut lines on how far computers, as teaching and learning tools,

complement the current pedagogical practices without conflicting with standardized testing processes as set by the DBE.

Llomaki's study also highlighted that:

> schools which have special ICT projects … for improving pedagogy … have led to true changes in teaching practices. Many teachers adopted student-centred and collaborative, inquiry-oriented teaching practices as well as practices that supported students' authentic activities, independent work, knowledge building, and students' responsibility. (Llomaki, 2008:4).

Likewise, Eristi et al. (2012:31) observed, in their study about teachers' views concerning effective use of technology in classrooms, that:

> learning should be supported when learners have to solve real-world problems; when their knowledge or readiness levels are activated in the process to establish the basis of new knowledge; when the information is applied by the learner; and when the information is integrated into the learner's world effectively.

These foregoing statements point to the fact that where there is proper teacher guidance, support and capacitation on when and how to integrate computers in teaching and learning, computers could inevitably culminate in better learner achievement. The researcher feels that teachers fail to relevantly implement computer policies because of uncertainties as to how they can mesh old rudimentary pedagogical practices with new technology of the 21st century, and at the same time satisfy the requirements of standardized external examinations and assessment policies.

Even though some strides were noticed towards change in imparting lessons, some teachers were perceived to be still leaning towards old teacher-centred strategies (Llomaki, 2008:4), which indicated that pedagogical changes were slow even in well-organized developmental projects. Nevertheless, Llomaki (2008:4)found that

“teachers used various approaches or mixed them, based on the situation, teaching and learning goals, and on their pedagogical and technical competence.” Thus where teacher pedagogical support was available, change towards better learner-centred and situational teaching was apparent Therefore proper alignment of curriculum with changes in technological and pedagogical approaches could result in some positive changes in teaching and learning in our secondary schools.

2.10 LEARNERS’ PERSPECTIVES ON USING COMPUTERS AS A TOOL TO ENHANCE LEARNING

Llomaki (2008:4) asserted: “There is a generation gap in ICT use and competence between teachers and students. … new functionalities change many of our existing conceptions, values, attitudes and practices.” In this instance students felt that technology is used better outside the school than in it, hence they found it boring to use it within the school environment. Teachers need to somehow learn along with their learners so that they can integrate computers in a more motivating manner that appeals to their learners’ senses. The researcher, however, feels that if computers are used more outside the school without teachers’ control and guidance, it could be bad for students’ work as they would presumably concentrate on aspects that unnecessarily distracted their attention. Nevertheless, assignments and homework are dealt with well outside the school environment, thus promoting independent and critical thinking in students.

In their study, Deaney, Ruthven & Hennessy (2003), whose purpose was to explore pupils’ views on the use of ICT in teaching and learning in Grades 8, 10 and 12 in six secondary schools in England, made use of group interviews to solicit data on learners’ perceptions.

> Pupils saw computer-based tools and resources as helping not just to effect tasks and improve presentation, but also to refine work and trial options. They associated the use of such tools and resources with changes in working ambience and classroom relations, as well as with

raised interest and increased motivation on their part (Deaney et al., 2003:1).

These authors found that using computers allowed pupils to engage with more challenging tasks, although they were concerned that changes that come with the integration of computers in their learning could displace valuable teaching. The researcher feels that use of group interviews was suitable as it allowed the researchers to probe further when given information was unclear. Although use of one method could result in biased and less generalizable findings, pedagogical use of computers, by a knowledgeable and skilful teacher, could result in real learner performance. Nevertheless, Deaney et al. comprehensively and thematically analysed their data in categories such as tasks effected, refinement assisted, ambience altered and motivation changed, which made their revelations sound and representative of the learners' views.

Similarly, Gokcearslan (2017) carried out a study to find out the relationship between the level of students' acceptance of tablet computers and their level of self-directed learning with technology. To make the outcome of the research authentic and generalizable the researcher used a mixed method paradigm to solicit data from a sample of 414 students in Turkey. According to this investigation, the attitude of students was seen to be playing a pivotal role in determining the level of usage of computers as a tool (Gokcearslan, 2017:42); hence the adoption of the following model. Perceived ease of use affects perceived usefulness, which cascadingly affects the intention to use computers and the students' ultimate usage behaviour. (Gokcearslan, 2017:42). This cascading relationship can be further illustrated as follows:

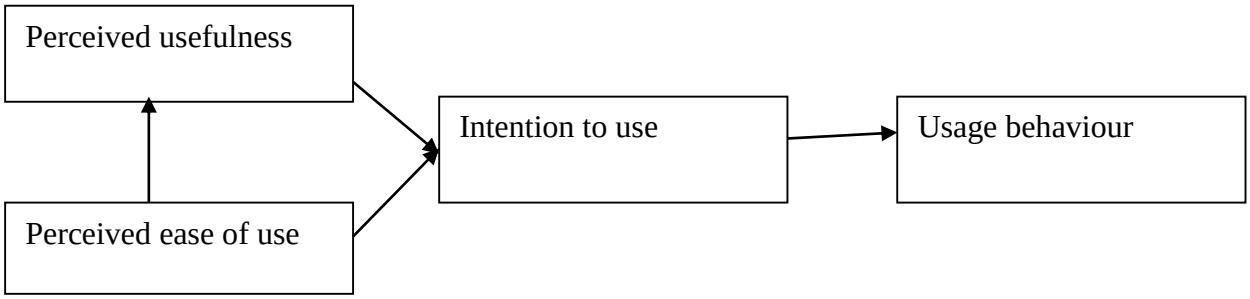


Figure 2.1: <u>Adopted</u>: Technology Acceptance Model (Davis, 1989)

The study revealed that students perceived the use of tablet computers in learning as less useful, which the researcher attributed to poorly prepared lesson materials and activities that could promote authentic learning (Gokcearslan 2017:50). In concurrence with a number of authorities, as was alluded to in this research, Gokcearslan asserted that teachers' knowledge and skills in selection and use of computer resources promote effective use and guidance of students in the learning process.

The present researcher thus concludes that tablet computers are less useful if students are not comprehensively guided and controlled as they use such computer tools. Students also indicated that use of tablets distracted the smooth learning process owing to lack of guidance by their teachers, who proved to lag behind in terms of knowledge and skills. Battery problems were perceived as one of the major problems which were encountered by students in the process of using tablets.

From the perspectives of learners, using computers is possible only if relevant hardware and software is readily available to both teachers and students. Another view of students was that there is a gap between the knowledge and skills teachers possess and the level of guidance they are expected to dispense for learners to meaningfully learn using computers.

2.11 SUMMARY OF CHAPTER

This chapter discussed issues pertaining to literature reviewed on the use of computers as a tool in teaching and learning in secondary schools. The discussion began with analysis of connectivism, the theory on which this study is grounded. This theory of the digital era emphasizes that we are living in a dynamic world of interconnectedness in which information and ideas are always changing and growing exponentially with the passage of time; hence what could be correct today could be obsolete knowledge tomorrow.

This part was followed by a survey of the empirical studies on computer use as a tool in teaching and learning. It is the view of many researchers that computers play a

pivotal role in enhancing authentic learner academic achievement, as learners are given the opportunity to construct their own knowledge through a myriad avenues opened through the use of computers. It was revealed, however, that computers are only as good as the teacher who uses them. This means that if a teacher does not know how to 'manoeuvre' his/her way through a computer's facilities it will remain a white elephant in the school. South African policies on e-education were also discussed in line with the importance of the integration of computers in our schools. Literature revealed that policies are not completely translated into practice owing to unclear communication and coordination between policymakers, implementers and other partners in education.

The chapter penultimately, looked at common ways through which computers are used in our schools. Studies reveal that computers are commonly used through CAL, CMI and CAI. These tools are believed to be very useful in teaching and learning, though it was noted that they are underused in developing countries owing to teachers' incompetence.

Finally, views of both teachers and learners on the extent to which computers could be regarded as effective tools were also explored in detail. It is the view of teachers and learners that computers as a tool are vital in secondary schools. However, they are unsure exactly when and how computers should be used to complement current teaching without conflicting with standardized assessment standards as set by the DBE. Nevertheless, in a study whose purpose was to establish the attitudes of teachers and students towards use of computer technology is geography education, Osodo, Indoshi and Ongati (2010:7) observed that teachers and students perceived the use of computer technology positively. This could mean that positive attitudes would translate into efficient and effective use of computers as a tool in our secondary schools. Generally, it has been established that the developed world is in the vanguard when it comes to computer use and research into teaching and learning in secondary schools.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In the previous chapter the researcher contextually explored the use of computers in teaching and learning in secondary schools from the international and national perspectives. Connectivism, which is the theoretical framework in which this study is grounded, was discussed in the detail it deserved. The researcher then zoomed into contextualization of the use of computers as a tool in South African secondary schools. In this regard the researcher began discussion of the South African e-education policies. This was followed by challenges encountered, and corresponding national strategies to overcome hurdles in the secondary schools were also discussed in detail. The researcher then delved into literature on developed and developing trends in the use of computers in their respective education systems. Lastly, the previous chapter rounded off by evaluating literature pertaining to teachers' and learners' perspectives, respectively, on computer usage for instruction and learning in secondary schools.

This chapter discusses the research methodology employed for this study, whose research instruments were aimed to facilitate data collection and analysis to comply with the study objectives as stipulated in chapter one.

This chapter specifically focuses on the research paradigm; research design; target population; sampling procedures; description of data collection procedures, specifically the instruments; data analysis and presentation; reliability and validity of collected data; and ethical considerations followed during the study.

3.2 RESEARCH PARADIGM

The qualitative paradigm, an interpretivist model, was employed to investigate this research problem. De Vos, Strydom, Fouché and Delport (2011) and Bertram and Christiansen (2016) posited that research paradigm refers to an established model

which is generally accepted by the generality of the research community. Therefore, in order to ascertain general feelings, perceptions and views of the participants about computer usage in secondary schools, a qualitative paradigm was adopted. The researcher, in this particular instance, strongly felt that it was reasonably apt to adopt this paradigm because of its strength grounded in its assumption of social interpretations by individuals, which presumably allowed the researcher to develop usable knowledge by collecting primarily verbal data through an intensive study of the specific phenomenon (use of computer tools) and then subjecting collected data to analytic induction (Bricki and Green, 2017).

The adoption of the qualitative paradigm provided an in-depth understanding of the realities of the phenomenon under study by intensively exploring the participants' experiences making use of multi-method technique (teacher semi-structured interviews, and semi-structured focus group interviews for learners and participant observation), which involved an interpretative and naturalistic approach to its subject matter (Denzin and Lincoln, 1994; 2018; Edmonds & Kennedy, 2017). De Vos et al. (2011) asserted that the qualitative paradigm promotes understanding of phenomena in their natural settings, which enhances understanding about people's behaviour. As the researcher specifically mentioned, this study was conducted using a variety of methods (triangulation), which used qualifying words and descriptions to investigate and record a phenomenon in its natural setting (Bless, Higson-Smith & Kagee, 2006; Bless, Higson-Smith & Sithole, 2019).

In a nutshell, the researcher was convinced that the qualitative paradigm promoted exploration of reliable data that could go a long way in bringing positive change in the use of computers in teaching and learning. Above all, this paradigm allowed the researcher to study the use of computers in a secondary school setting, thus making sense and interpreting this phenomenon in terms of the meanings teachers and learners bring to it. The rationale for using this approach was based on the perspective that it is *flexible* and generates rich, trustworthy and reliable data.

Thus this study is grounded in the interpretivist paradigm. Much research evidence (Cohen, Manion & Morrison, 2010; 2012; 2018; Yanow & Schwartz-Shea, 2011; Creswell, 2013; 2014) indicates that the interpretive paradigm allows researchers to

view the world through the perceptions and experiences of the participants. My study seeks to explore both teachers' and learners' views of and experiences in the use of computers as a tool in teaching and learning in secondary schools.

3.3 RESEARCH DESIGN

The researcher conducted this study using a case study design (De Vos et al., 2011) for the problem about computer usage that necessitated investigation, as was specified in Chapter One. A research design is a plan indicating a targeted population and corresponding samples, used to obtain research subjects and collect information from them (Welman, Kruger & Mitchell, 2010; Creswell, 2013; Aurin, Heath,& Howells, 2016). The researcher regarded the use of a case study as appropriate, because it allowed exploration of detailed and in-depth (Denzin & Lincoln, 2018) data on the use of computers in teaching and learning in secondary schools.

The researcher strongly believed that through adoption of case study (Gorard, 2013) participants' (teachers' and learners') feelings and attitudes towards use of computer tools would be aptly captured, reflecting a more meaningful perspective in this regard. In concurrence with Welman et al. (2010), the researcher used a limited and reasonably manageable representative number of research participants to ensure that they could be intensively studied. In corroboration, Rule and John (2011) observed that cases could be distinctive persons, phenomena or programmes in their unique attributes.

Within this study the researcher focused on a single case about the use of computers as tool in secondary schools in Pinetown District so as to get a better and trustworthy and transferable insight. Finally, in concurrence with qualitative perspectives, because in this particular instance it was the researcher's own findings and conclusions based on his experiences and observations pertaining to this particular phenomenon under study, which were expressed verbatim, salient qualitative findings could rather be regarded transferable from one study to a new situation.

3.4 TARGET POPULATION AND SAMPLING PROCEDURES

The major aim of this study was to explore teachers and learners' perspectives about use of computers as a tool for teaching and learning in Pinetown District of KwaZulu-Natal Province, South Africa. Consequently, the targeted population was from secondary school teachers and learners in the said district. Precisely the research population constituted grade 10 and 11 teachers from the three sampled schools. Bless et al. (2006) and Bertram and Christiansen (2016) concurred that population is about the entire set of subjects about which the researcher determines specific characteristics. The researcher used the population of Durban North-West circuit in Pinetown District secondary schools. Grades 10 and 11 learners and their respective teachers constituted the specific population for this study.

The researcher used a purposive sampling procedure having in mind the rationale that coming up with such a sample would enable him to target participants whose schools were assumed to be using computers for teaching and learning. Purposive sampling was adopted because of the specific purpose of the research (Edmonds & Kennedy, 2017). Bertram and Christiansen (2016:60) observe: "Purposive sampling…targets a specific group knowing that the group does not represent the wider population…it simply represents itself." Consequently, the sample constituted Mafukuzela Ghandi (rural ward) and KwaMashu Central (urban ward) of Durban North-West circuit secondary schools with computers. Researcher felt that having schools from both urban and rural settings would allow for comparison and contrasting of degree of computer use in different geographical environments. Specifically, the delineated area happened to have two urban and one rural school with computers, respectively.

The Grade 10 and 11 learners constituted a sample of 30 learners from two urban ward schools and one rural ward school respectively. Two teachers, who taught these grades, were selected purposively as well from each of these schools, which amounted to six teachers in all. The same teachers purposively assisted in selecting one learner from each of the five areas of specialisation like Commerce, Humanities, etc. Therefore, the sample was as follows: Three schools (two urban and one rural); 15Grade 10 learners and 15Grade 11 learners, constituting five learners from Grade

10 and five from Grade 11 per school, i.e., 10X3=30 learners. Purposive sampling was adopted in the selection of the three secondary schools by virtue of their proximity to where the researcher worked, coupled with their "privilege" of having computers, which constituted an essential element for the research to be instituted. The researcher worked and lived in the selected urban ward and near the rural ward. Comparison of rural and urban schools became possible. This choice was regarded as fair because it allowed that travelling costs became manageable. The scenario also allowed the researcher more time in the areas, thereby promoting an intensive study and enhancing the validity of the study outcome. The sample was thus created from one circuit, two wards, six teachers and 30 learners from the three secondary schools.

3.5 DESCRIPTION OF DATA COLLECTION INSTRUMENTS AND PROCEDURES

The researcher employed both semi-structured interviews for teachers and semi-structured focus group interviews for learners, which constituted major instruments for data collection in this study. He unequivocally believes that results yielded through interviews depend on the skills of the interviewer in structuring the questions, posed to the participants and the making of follow-up questions in light of the conversation(s).

Semi-structured, one-to-one interviews with teachers were used to address research objective 1; and semi-structured focus group interviews for learners addressed research objective 2. The underlying assumption was that these interviews would allow teachers and learners to provide more explorative information about their views concerning use of computer tools in teaching and learning. As advised by Bertram and Christiansen (2016:80), interviews constitute a procedure of data collection, which is a structured and focused conversation where the researcher intends to have a specific research question answered by the respondent.

To achieve the foregoing, the researcher established rapport with the interviewees before the actual interviews. The researcher also supplied them with the agreed visiting plan for interviews and classroom observations times. Furthermore,

assurance concerning anonymity and confidentiality was one of the most important issues that the researcher advanced to interviewees so that they could speak out honestly without fear or favour about what was under investigation. The researcher voice-recorded the participants during interviews and delved into the transcription process soon after each interview session. To accentuate research validity, the researcher made notes on the non-verbal behaviour of respondents, their body language, since very rich qualitative information could be obtained through observations and interviews. The researcher also went back to the participants for further probing where there was unclear data during the transcription process from audio interviews.

Participant observation (classroom observation) was also performed to substantiate information sought through semi-structured interviews. This was done through lesson observations (one lesson per teacher). In this regard the researcher wrote detailed notes following the structured template during lesson observations. He then discussed the lesson outcome with the teachers to get their reflection on learner gains when they taught using computers, and explored teacher perspectives further on the level of support they were getting for using computers in the actual instruction process.

3.5.1 Semi-structured Interviews (teachers)

As has been alluded to above, the researcher explored perceptions of teachers about use of computers as a tool, making use of semi-structured in-depth interviews, thus addressing research objective 1. Semi-structured interview techniques allowed the researcher to extract a greater wealth of information because of their qualitative nature (Welman, Kruger & Mitchell, 2010).The interviews began with questions on teacher demographical information as indicated in Table 4.1. This approach had the following advantages: the researcher asked a question, then the participant had free latitude to answer the way he/she felt pertinent in line with the question and follow-ups. The researcher continued probing in light of the answers given by research subject(s), resulting in possibly rich data being extracted, and the surfacing of the realities about the research problem at stake. However, the researcher believes that if the interviewer fails to control and direct the flow of the interview process, and gets

carried away by the interviewee's talking, he/she will end up wasting time voice-recording irrelevant data. The researcher tried to reduce such negative effects by meticulously probing and redirecting the participants so that pertinent issues could be possibly revealed.

For the teachers, the researcher used the one-to-one interview approach on the assumption that they are mature and confident enough to air their views, given that they are in the teaching profession through interview processes they underwent before. A purposeful sample of six teachers could feasibly be interviewed with rigour in view of time constraints affecting the researcher, who happened to be a full-time educator as well.

Procedurally, the researcher went to sampled schools to seek for permission and explained the objectives and purpose of the research. Consent forms were issued to respondent teachers for completion and signing before the actual interview process. The researcher then carried out the interviews on agreed dates using smart phones to voice-record the proceedings. Permission was also sought for further follow-ups and probing in the event of unclear information during the transcription process. A time frame for each interview was set to range from 20 minutes to one hour depending on participant(s) interviewed, and/or the amount of information they were comfortably willing to highlight.

3.5.2 Semi-structured focus group Interviews (learners)

The second objective was addressed through semi-structured in-depth interviews for learners, where an interview schedule was followed. Learners were interviewed in groups of five (focus groups) per grade to save time, build confidence and relax the learners as they discussed and answered the interview questions. Creswell (2013:164) notes that "focus groups are advantageous when the interactions among interviewees are similar and cooperative with each other, when time to collect information is limited, and when individuals interviewed one-on-one may be hesitant to provide information."One more advantage of employing semi-structured interviews for learners is apparent when the interviewer asks more open-ended questions that

presumably do not ‘suffocate’ interviewees, unlike structured interviews characterised by closed-ended questions.

To solicit more authentic information, the researcher ensured homogeneity of focus groups by grouping Grade 10s together and Grade 11s on their own. Although these cohort groups were homogenous in terms of grade level, small age differences were noticed. The researcher, nevertheless, found out that age variables did not confound the flow of focus group discussions as he meticulously controlled the smooth flow of the conversations.

The researcher also allowed room for learners to give open-ended responses to improve the quality of data elicited. He tried as much as possible to control the flow of this type of interview discussion by providing learners turns to speak, and strategically monitoring and controlling the domineering learners throughout the process. To make sure learners could speak freely the researcher addressed them with pseudonyms such as learner A, B, etc. Pseudonyms were used to uphold anonymity and confidentiality.

3.5.3 Participant observation (classroom observation)

Agreeing with Bertram and Christiansen (2016:84), the researcher practically observed teachers delivering lessons to ascertain that teachers and learners did express themselves, or did not, during interviews. Since observations allow the researcher to see a phenomenon from another angle, besides through interviews, observation enhances the research outcome of the study; it is presumably regarded as more valid and reliable. Supporting the idea of triangulating interviews with observations, Bertram and Christiansen (2016:94) comment: It is well documented that teachers often teach in different ways to how they *say* they teach. When using observation, the researcher can see what is actually happening in a classroom. In light of this the researcher felt obliged to triangulate data collection techniques to enhance the trustworthiness and perhaps the transferability of the research findings.

Objective 3 was also, in a way, addressed through use of classroom observations where the six participating teachers were observed using computer technology during

their lesson presentations. One lesson per teacher was observed, using a structured observation template to solicit data thus a total of six lessons were observed. Making reference to structured observation, Bertram and Christiansen (2016:85) posit, “If a researcher has a very clear idea of what he is looking for in the classroom, he will use a structured observation schedule… have the observation categories worked out in advance…often mean that the data can be categorised and counted.” Observations have the strength that they are a powerful data collection method for gaining insight into situations, that is not necessarily have to solely rely on information of others sought through interviews (Bertram & Christiansen, 2016).

The researcher feels that despite the aforementioned advantages, observations have the weakness that it is almost impossible for the researcher to accurately observe the way the teacher delivers his/her lesson and equally capturing accurately how learners will be responding to a specific pedagogical/didactical approach being used by the teacher. Because the observer is the key measurement instrument in qualitative research what he/she chooses to observe and interprets squarely rests with his/her view of the world and what he/she expects to see (Bertram & Christiansen, 2016:94). In light of Bertram and Christiansen assertions, the researcher tried as much as possible to be attentive and follow the template as much as was possible.

Another disadvantage of observation, noted by the researcher was that his presence seemed to make learners and teachers behave differently (Hawthorne Effect), which presumably could cloud the findings of the study. Nevertheless, the researcher still opined that use of interviews and observation goes a long way in improving the validity and reliability of the research findings.

3.6 DATA ANALYSIS AND PRESENTATION

Data analysis is a process of processing raw facts (data) into information that is ready for use to solve problems besieging the education system such as failure to effectively use computers for meaningful learner performance by the educators. In concurrence with De Vos et al. (2011), the researcher started data analysis and interpretation as soon as the first interview and observation data were collected. After

collecting the data, he embarked on pre-processing of information, especially obtained through semi-structured interviews and observations. Pre-processing of data promotes that modifications be carried out in the light of initial findings or discrepancies, which required correspondingly relevant modifications in the questioning styles.

When all the data (record notes from data obtained through participant observations, unstructured interviews and focus groups; and researcher memos and reflections, which were in the form of narratives or notes) had been collected, the researcher used thematic analysis to compare and contrast explanations and descriptions of the phenomena under study. Thematic analysis of data involves analysing transcripts, identifying significant themes and putting them together in accordance with their characteristics (De Vos et al., 2011).The researcher read the data several times in order to come up with centrally conspicuous themes that coded and recoded into well-refined categories from which descriptive write-ups about phenomena investigated were established.

The researcher specifically employed a constantly comparative method of data analysis, that is, subjected solicited data analysis to comparison of relationships between concepts and categories noted from rural and urban wards. He continued with this process until no new significant categories came up. Differences and similarities were clustered until no new categories emerged, eliminating duplication as much as possible. Data were then put into thematic charts so that themes could be checked across, promoting more meaningful mapping and interpretation of concepts, relationships, associations and significant patterns. Finally, qualitative data analysis was used to present data thematically in prose form. A table was used to tabulate teacher demographical data categories, which formed a basis of narrative analysis for final reporting.

3.7 VALIDITY AND RELIABILITY

The researcher made all possible efforts to ensure the validity and reliability of the findings by ensuring accuracy of collected research data through voice-recorded

teacher interviews and learner focus-group interviews, and through observation of the same respondents in live classroom situations. Silverman (2016:414) explains: “Reliability and validity are the technical terms that refer to the objectivity and credibility of research”. Therefore, the researcher tried to pay meticulous attention to validity and reliability to enhance the rigour of this research, which possibly could allow fellow researchers to accept his findings as credible, trustworthy and transferable. The researcher also triangulated data collection instruments, which possibly further enhances the validity and reliability of this study. To underline his adherence to the foregoing, the researcher transcribed the views, opinions and experiences of the interviewees so objectively that nothing in the interview situation itself could mar the researcher’s true reflection of the phenomenon under investigation.

Although some shortcomings could creep in through the fact that the researcher is fallible, just like any other human being, and immersed in the same educational system as the participants, and hence bound to have similar feelings, perceptions and opinions about the phenomenon under study, the researcher made all possible effort to report and analyse *only* what research participants expressed, including interpreting their body language.

3.7.1 Validity

The researcher ensured the validity of his research instruments by carrying out a pilot study in the nearby secondary school before delving into the actual research. A valid research instrument is the one that measures what it purports to measure as accurately as possible. Bertram and Christiansen (2016:188) state that construct validity is the extent to which interview and observation instruments measure what the researcher intends to find out. The researcher strongly concurs that for any research to be credible and unambiguous the data collected should reflect what significantly prevails in the case under study.

To ensure attainment of valid research findings, the researcher employed semi-structured interviews for both teachers and learner-focus groups to explore perceptions about the use of computers as a tool in teaching and learning. The

researcher made all possible attempts to make sure that the qualitative research basically concentrated on eliciting information pertaining to feelings, opinions, experiences, knowledge and perceptions of the respondents about computer usage.

The researcher observed the same participating teachers using computer tools in their lessons, thus triangulating the data collection methods so as to further increase the ultimate trustworthiness of the data. Aurin et al. (2016:64) state: “Triangulation … decreases the chance of systematic bias due to relying only on one specific method.” Aurin et al. (2016), Bertram and Christiansen (2016), Silverman (2016) and Creswell (2013) advise that drawing evidence from a variety of data sources helps promote the validity of the research findings. To further strengthen their validity, the researcher took cognisance of participants’ body language throughout the interviews and observations, thus capturing what respondents were somehow reluctant to express by word of mouth.

Last, but not least, absolute assurance of confidentiality was highlighted, evident in all voice records where pseudonyms were given, to allow the participants to speak freely and honestly on the phenomenon under investigation, which further promoted the validity of the findings of this research. The researcher also tried as much as possible to use simple language so as to promote effective and efficient collection of authentic, credible data.

The researcher did not confine the validity criterion to the data collection process, but extended its application to the data analysis itself. He rigorously read and reread, coded and recoded the collected data until the point of saturation so as to come up with valid and credible results.

Emphasising the validity of data interpretation and analysis, Lacey and Luff (2009:27) state: “The ability of the findings to represent the ‘truth’ may not be appropriate if we accept the existence and importance of multiple ‘truths’. Rather, validity will be judged by the extent to which an account seems to fairly and accurately represent the data collected.” In concurrence with these scholars, the researcher used the actual quotations of different respondents in data interpretation, acknowledging some shortcomings that surfaced due to the fact that he is immersed in the system of

education as a teacher himself, hence bias in data interpretation could occur through his prejudgements and vested interest in the subject under study. However, he consistently kept comprehensive and self-reflective notes and tried as much as possible to avoid/reduce serious observer effects clouding the findings; and transparently made his interpretation and analysis of the main themes available to co-scholars for confirmation.

3.7.2 Reliability

Reliability is the consistency with which a measurement instrument measures what it is supposed to measure, i.e., the consistency with which interviews and observations solicit valid data – in this case, about teacher and learner perceptions of the use of computers as a tool in teaching and learning in secondary schools. Creswell (2013:253) asserts, “In qualitative research, reliability often refers to the stability of responses to multiple coders of data sets.” The researcher considered use of interviews and observation as justifiable instruments in this study because they promoted what he believes is a reliable reflection of the central themes about the use of computers as a tool. The way the researcher has described the approach and procedures of data interpretation and analysis in the foregoing paragraphs has underlined the fact that the findings are trustworthy and transferrable, hence can be relied on as a true reflection of what is portrayed in the case studied.

In short, the researcher acknowledges that the validity and reliability of research are inseparable; an invalid research instrument cannot yield reliable findings. Therefore, any research instrument should consistently measure what it purports to measure if the results of a study are to be regarded as trustworthy, credible, and transferrable.

3.8 ETHICAL CONSIDERATIONS

This study was conducted in the form of a case study, and the following procedures were followed: Ethical clearance from the University of Zululand Research Ethics Committee (Appendix A) was granted to the researcher before the data were collected. An application seeking permission was sent to the Department of Basic

Education in the province of Kwazulu-Natal, and permission was granted (Appendix C); Applications for permission to conduct research were also forwarded, through the Directorate of Pinetown District, to Durban North-West Circuit and to KwaMashu Central and Mafukuzela Ghandi wards of the three sampled secondary school principals, and permission was granted (Appendix B).Informed consent declaration forms were administered to teachers, learners and parents/guardians of Grade 10 and 11 participating minors in both English and IsiZulu, and were accordingly signed before the interviewing and lesson observation processes began(Appendix D).

The researcher strove to uphold the ethical principle of a participant's rights to privacy, confidentiality and anonymity by making use of pseudonyms for participating research subjects (teachers and learners). Even the names of the sampled schools were not mentioned; instead they were referred as School A, B and C. Furthermore, a teacher's identity and school were, for example, noted as Teacher CA*,* meaning the teacher was from secondary school C, and his/her corresponding pseudonym was A. For learner focus group interviews, the school is identified by the first letter, and the learner by the immediate following number and letter. For example, Learner A10B means the school is A and the learner number in school A is 10B, meaning that the learner was from a focus group in Grade 10.

The other ethical principles that were upheld by the researcher were accountability and being respectful throughout the process. The researcher strove to be trustworthy and honest about what the research involved, and how and why the research would be carried out. Where respondents were minors (16 years or under in this research) the researcher sought, first, the permission of parents/guardians to authorise the child to participate in the study. Participants were informed as well that they had a right to decline to participate in the research or even withdraw, at any time, during the course of the research.

The informed consent of the research subjects was not compromised. Before obtaining each participant's informed consent, the general theme of the research was made explicit in a covering letter. Basically, the covering letter included who the researcher was; why the data was required; procedures used in the research; the participant's right to decline to participate at any time; an assurance of confidentiality

and/or anonymity, the address of the researcher, and the significance of the research. Acknowledgement of similar research carried out was mandatory on the part of the researcher.

3.9 CHAPTER SUMMARY

This chapter highlighted central aspects of the methodology used in this research. A qualitative approach and the interpretivist paradigm were adopted in this study. A qualitative case study about the use of computers as a tool in teaching and learning is the research design used, and its advantages and disadvantages were described. The specifics on the targeted population, sampling procedure and size of the sample were explained, and the reason why the purposive sampling method was preferred to others, to come up with a small sample, was discussed in detail.

The teachers and learner focus group, semi-structured interviews were also discussed in detail. Besides eliciting research data using interviews, the researcher found it worthwhile to triangulate the data with participant observation so as to come up with more convincing and presumably authentic information, thus enhancing the validity and reliability of the study findings. Finally, the validity and reliability of the research were explained in detail. Ethical issues and required procedures up to the actual data collection, analysis and interpretation were highlighted.

CHAPTER 4

DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

4.1 INTRODUCTION

Data analysis and findings of this study are presented in two parts (teachers' views and learners' views) addressing the following research objectives of the study:

- Explore teachers' views about using computers as a tool in teaching and learning in secondary schools.
- Explore learners' views about using computers as a tool in teaching and learning in secondary schools.
- Identify the kind of classroom support and guidance that is available to teachers to facilitate the use of computers as a tool in teaching and learning in secondary schools.

The analysis of the semi-structured interviews takes the following pattern:

(a) for teacher interviews, the school is identified by the first letter and the teacher by the immediately following letter. For example, teacher AB means the school is A and the teacher in school A is B;
(b) for learner focus group interviews, the school is identified by the first letter and the learner is the immediately following number & letter. For example, Learner A10B means the school is A, and the learner number in school A is 10B, meaning that the learner was from focus group B in Grade 10.

4.2 SECTION A: TEACHERS' VIEWS ABOUT USING COMPUTERS AS A TOOL IN TEACHING AND LEARNING IN SECONDARY SCHOOLS

This section of the chapter comprises systematic analysis and presentation of information that was sought through semi-structured interviews carried out with six teachers from the three sampled secondary schools in Pinetown District in the province of KwaZulu-Natal. The themes extracted through semi-structured teacher interviews were meant to address objectives 1 and 3, specifically teachers' views,

challenges and the kind of stakeholder support available to them to facilitate the use of computers as a tool in teaching and learning in secondary schools. In this regard, the researcher came up with the following themes:

4.2.1 Teachers' demographical information
4.2.2 Salient importance of computers for teaching and learning
4.2.3 Common computer uses
4.2.4 Nurturing learner computer usage
4.2.5 Challenges, stakeholder support and suggestions
4.2.5.1 Biases in computer use
4.2.5.2 Irregular use of computers as a tool
4.2.5.3 Rampant Theft of computer resources

4.2.1 Teachers' demographical information

The researcher believed it would be most suitable to begin this section with the participants' demographical data as it is necessary to ascertain the characteristics of those involved in the study. These data were quantitatively analysed and further supported by the respective quotations. Concerning the teachers' demography, the researcher wished to find some form of correlation between a teacher's years of experience and acquired computer literacy skills, and the frequency of computer use for teaching and learning. Teachers' demographical data (Table 4.1) were tabulated, followed by their analysis and interpretation.

The presentation of demographical information was then followed by the analysis of detailed data solicited through the use of semi-structured interviews on the use of computers *per se*. This section of qualitative data analysis and interpretation was presented with the aid of the quotations and, in some cases, supporting pictures, of the data about the teachers' perspectives pertaining to the use of computers in teaching and learning.

The teachers' demography includes attributes about overall years of teaching experience, years of experience in the FET phase, computer-related qualifications (formal or informal), and corresponding frequency of use of computer tools such as

the internet and email. In this study, formal qualifications refer to those offered by an accredited training institution, hence given a specific framework by the South African Qualifications Authority (SAQA), while informal computer qualifications refer to those not recognized by SAQA, such as certificates of participation or achievement obtained in an unaccredited institution or through workshops.

Table 4.1: Teachers' Demographic Information

Teacher	**Overall Years Teaching Experience** (1-5); (6-10); (11-15) (16-20); (21-25); (26-30)	**Years of Teaching Experience in the FET Phase**	**Computer-Related Qualification(s)**	**Formal/Informal**	**Frequency of use of computer tools such as internet & email**
AA	21-25	21 Years	1. Basic Computer Literacy Certificate 2. Computer Literacy (ClickMaths)	Informal	Everyday
AB	1-5	2 Years	Computer Literacy (ClickMaths)	Informal	Almost everyday
BA	1-5	4 Years	Computer modules as part of BEd degree	Informal	Almost everyday
BB	26-30	29 Years	1. DOS Certificate 2. Computer Literacy	Informal	Very little/few times
CA	10-15	10 Years	1. ICDL 2. Advanced Certificate in Computer Integrated Education	Formal	Rarely
CC	10-15	15 Years	Nil	N/A	Almost everyday

The number of teachers that were interviewed was six. Five of the teachers indicated that they had computer-related qualifications. Four of the participants indicated that they were quite experienced, having at least 15 to 30 years of teaching. However, one (teacher CA) of the participants with 10 years' experience indicated that during the first five years of her teaching she was not teaching in the FET phase. Two of the interviewed teachers indicated that they were relatively new (1-5 years) in the teaching fraternity, and for all these few years of their experience they had taught in the FET phase. It was coincidentally established that the teacher participant complement was composed of both young and older generation, which allowed that contrasting perspectives be reflected on how computer use is valued for teaching and learning.

Of the six teachers, only one held formal computer-related qualifications that were done through the DBE's initiatives (International Driving Licence courses). Referring to the type of computer qualifications, and how she managed to obtain them, teacher CA asserted that:

> *"I've done the International Computers Driving Licence (ICDL). … I've also done the Advanced Certificate in Computer Integrated Education. The Department … then introduced this course, the ICDL; it was introduced by the Department; it was sponsored by the Department." [Teacher CA]*

The other five teachers either received computer-related qualifications through personal initiative, through DoE workshops, or completed some computer literacy modules as part of their Bachelor of Education (B.Ed.) courses. In corroboration of this argument above, teacher BA reported:

> "*Eeeh, there is no specific computer qualification, but I did computers as part of my undergraduate degree*. *… I only got it at varsity as part of my B.Ed. degree. There were one or two of the modules we did on computers. And I've a few other (computer) modules as well as part of my Honour's degree." [Teacher BA]*

In the foregoing situation the DoE's efforts in trying to make sure that teachers become computer literate have recently *only* been evidenced by inclusion of some computer literacy modules in the B.Ed. courses of the University curricula, as was rightly highlighted by teacher BA. In contrast, the researcher observed with dismay

that after graduation of the millennial generation teachers, like teacher BA with four years of experience, they could either use these computer skills or not for teaching and learning. The researcher found that computer usage depended upon *personal* wishes and/or *availability* of computers in the schools where they taught, or they had to buy their own computer resources if they could afford them, and wanted to use computers for instruction.

With regard to the older generation of teachers, the researcher found that frequency of computer use, given the aforementioned phenomenon, concurrently depended on one's *initiative(s)*, to take up a computer literacy course, as it appeared not to be compulsory, or aligned in any way with the curriculum, to apply their personally hard-earned computer skills. Irrespective of no apparent DoE effort through older teachers being in-serviced along the lines of computer literacy, to employ teachers for their computer literacy, there was evidence that these teachers took initiatives to capacitate themselves. Thus respondent teacher BB, of 29 years of teaching experience, who attained her computer literacy through workshops and personal initiatives, corroborated:

> "*Aaah, I took a course about four years back (meaning in 2014) at Imvana Training College. It was a private thing. But before that I was in another school, there was a course that we took. It was actually sort of a workshop in Stanger so we went there; it was DOS (Disc Operating System) just to be able to type, understanding the basics of the computer; it was just out of my own interest." [Teacher BB]*

Making reference to the rate of use of the computer tools such as internet, email, etc. by the teachers, teacher BB lamented:

> "*Ugh, very little! Very little! Few times, because as I've mentioned, we don't have internet … I've to buy data with my own money, so that I can access the internet; … Even though there is internet, it's not accessible to all of us…I've to borrow the cord that connects from the projector to the computer … so I haven't been able to use it properly in class because I've to borrow from another educator so that I'll show them in class … I asked the school to buy it for me and then up until now they haven't." [Teacher BB]*

Teacher AA recounted virtually similar experiences to the ones expressed by teacher BB above, when he said:

> *"I use a computer almost every day. Yaah, but internet connectivity is an issue so I depend on my smart phone for internet connectivity. I've got my own computer … I understand internet is very expensive in South Africa, but like I was saying to you I rely on my own smart phone for internet connectivity." [Teacher AA]*

In the above quotations, it is evident that the rate of use of computer tools such as internet depended on one's *initiative(s)* and the affordability of computer accessories and data to enhance internet connectivity for research. Therefore, frequency of computer use by the participating teachers proved to be very scant as was further indicated by teacher BB when she sadly mentioned that she was only seldom able to access and use the internet.

From Table 4.1 it is also conspicuous that of the five computer-literate teachers (formally/informally), there was no correlation between teacher experience and computer competence, and the frequency of use of computers as a tool in the sampled schools. However, it was established that one teacher of 15 years of teaching experience, who indicated that she had no computer-related qualification, could nevertheless use the computers *almost every day,* just like those who held computer-related qualifications, which reflected a positive attitude and personal initiative. When the researcher asked teacher CB whether she held any computer-related qualification, she replied:

> *"No. I don't have any qualifications. … Even though I do have basic knowledge of how to use the computer, I didn't go to any training." [Teacher CB]*

Regardless of not having computer-literate qualification(s), she highlighted how often she used computer tools such as the internet:

> *"Almost every day because I've my, what you call? No, no, no; the, the Modem. Yes." [Teacher CB]*

In concurrence with what teacher CB asserted above, the researcher mentioned, in the review of literature, that the *attitude* of any computer user was seen to be playing

a pivotal role in determining the rate of usage of computers as a tool for teaching and learning (Gokcearslan, 2017).

Another contrasting scenario, which surfaced when analysing *teachers' demographical data*, was the revelation of teacher CA who, irrespective of holding formal computer-related qualifications, indicated that she *rarely* used computer tools such as the internet owing to a lack of Internet facilities in the school. She stressed the reasons why she rarely used the internet:

> *"Unfortunately, our schools do not cater for us with the internet facilities because our subject is perceived as the subject that is expensive. So we find it very difficult; we use our means as educators to cater for the internet". [Teacher CA]*

The researcher found that there was no tangible correlation, among variables such as years of teaching experience, computer related qualifications and use of the computers for teaching and learning.

From the above discussion, the researcher found out that the rate of computer use in the sampled schools, across the curriculum, primarily depended on the individual teacher's attitude, his/her zeal about wanting to take the initiative to apply the computers as a tool to enhance his/her teaching and authentic learner performance in their respective subjects. The rate of computer use, although found to be scant, depended on how much money the teacher would be willing to spend, coupled with a positive attitude and the determination to ensure he/she gets connected to the internet facilities.

4.2.2 Salient importance of computers for teaching and learning

The teaching and learning process is so complex that teachers, because of the learners' varied innate and background characteristics, need to tactfully differentiate their teaching styles to correspond with the digital era in which they are currently living. Bhalla (2013) stresses that it is of utmost importance to employ tactics that appeal to the learners' senses so that they are kept motivated and feel the drive of wanting to learn more. Davidson, Richardson and Johns (2014)claim that there is clear evidence that the use of computers as a tool in education improves the quality

of instruction, thus making learning more motivating for learners, and keeping them engaged in given tasks. From the foregoing highlighted available evidence, as noted above, on the importance of computers the researcher has no doubt that computer tools constitute a foundation upon which quality secondary teaching and learning can be built in the 21st century, the era of technological connectivity.

Through their interviews, teachers expressed a virtually similar view that the computer as a tool plays a pivotal role in enabling learners' success. Teacher BA vehemently asserted:

> *"One knows that learners are different; some of them are visual learners; so … for their understanding, they need visuals or something that they could see so they could relate better; so I use it constantly (computer) and almost every day I use computer tools such as internet; almost every day of my teaching." [Teacher BA]*

Emphasizing the importance of computers as a supplementary pedagogical tool, teacher BA alluded unequivocally to the fact that the use of computers was essential because it aroused interest and brought about good behaviour in learners. Supporting the perspective that every learner is an individual, teacher BA asserted that:

> "*Concerning the computer as a pedagogical tool… most of the learners we teach say history is a boring subject, but for me it (computer) just sparks that interest in the learners; and especially as we are approaching the Fourth Industrial Revolution, one needs to be creative and innovative when teaching. … it makes the lesson … a little bit entertaining and it sparks that interest; … when you compare those classes that are using technology (computers), the difference in terms of behaviour and discipline of learners is huge. You, you see when you come and observe me teaching you'll see what disciplined learners they are because everybody is watching …, it just brings that curiosity which learners have when they are learning. So I've seen a lot of improvement, especially when it comes to the issue of discipline." [Teacher BA]*

The above respondent seemed to concur with the view that use of computers keeps learners active and focused, thus promoting meaningful learning (Edutopia, 2014). It

improves the learning process (DoE, 2004, White Paper 7). These comments leave the researcher with little doubt that when learners are introduced to a learning situation whereby they use different senses(seeing, listening & touching), they become so attentive that relevant performance is bound to be achieved.

Teacher CA seemed to stress similar views to the ones expressed by teacher BA when she said:

> *"We all know that as we are living in the world of technology, when learners finish school or when they're going to further their studies, the requirement is for them to have access to computers; they do not do handwritten assignments in most institutions. I don't know the institutions where they allow handwritten assignments and stuff. So I believe computers are very important; they assist learners in current skills or gaining skills in working with computers and it'll therefore be easy for him or her if he or she goes out of high school to be able to do whatever requires a computer if she had started using one in school." [Teacher CA]*

Teacher CB expressed similar views to those of teacher CA when she reflected on different kinds of improvements brought about by using computers.

> *"There's a lot. There's a lot. It makes things easy because as with our learners, even though it is good for them to have books, they cannot read and prepare for the exam, just by reading the books, so you have to take the chapter, summarize it, and then you give them the summary of the chapter." [Teacher CB]*

Vehemently stressing the importance of using computers as tools for teaching and learning, teacher BA highlighted "tangible" improvements evident, in terms of test marks, since he started using the computers in his lessons (history and social sciences). Smith and Hardman (2014) affirm that the use of computers motivates learners and enables access to hard-to-reach-learners. In the light of the marked improvements she witnessed, teacher BA commented:

"Mark-wise, when it comes to the improvement of the performance, I've seen a very steady growth; even lower-performing students are now better than when I first started with them. I've seen that when I hadn't used technology such as the computer one might have struggled to move them from where they were to where they are now; so it's been of great help and a great improvement." [Teacher BA]

Teacher AA also witnessed drastic improvements in learners' performance when teaching using computers specifically programmed to teach mathematics. Struggling learners were reported to be scoring better marks in mathematics, presumably motivated by learning to use computers. In this instance teacher AA proudly asserted:

"Using a Siyafunda project (only for mathematics), there's a learner that has improved from 30% to 60% in Mathematics paper 2, to be specific." [Teacher AA]

The same observations about learner improvements as were highlighted by teacher AA were also noted by another participant who had *merely two* years of teaching experience. Stressing the improvements she has noticed in the two years she has been teaching, when using computers in teaching mathematics, teacher AB recalled:

"The improvements that I've seen are that learners do things faster with the computer, unlike writing, because writing with the computer, you just delete and write each and every day. Everything is just neat and clean when they use a computer." [Teacher AB]

The advent of computers as a tool was also perceived to be enhancing learners' understanding when it comes to practical subjects like hospitality. Teacher BB, strongly supported this development:

"Basically I use the computer because I'm teaching a subject that has got practicals. And with Hospitality Studies the learners cannot access some of the information or the places they are supposed to learn about… so that they'll

be able to see the places where they've to know what's going on there with relevance to the subject. So I download some videos, some pictures, whatever will relate to the topic or the subject that I am teaching. … When we are dealing with beverages – wine, presentation of the wine, and maybe receiving the guests, because that is the practical side of it which the learners have to deal with in the kitchen or restaurants;… then show them so that they'll be able to understand. And also that helps them to have another picture because they are not used to going to these places."[Teacher BB]

From teacher BB's point of view, computers make abstract concepts more realistic, thus promoting better learner performance in tests. Teacher BB strongly felt that given the lack of physical resources for practicals in her school, which resulted in learners failing to pass the examinations, computers could close that very big gap in Hospitality Studies. Appreciating the supplementary pedagogical role played by computers in her subject, in making learners understand certain concepts like "*must"* in wine-making, she commented:

"Let me take again the, the wine. When am talking about MUST in the making of a wine, that is when you crush the grapes and then there is the pulp and then juice. So now, MUST indicates 'something that must be done' in English. But now, they've to understand what I mean by MUST, although it's the same spelling; so they've to see now what it looks like, what it is that I am talking about before the fermentation process, the purification process up until the wine is bottled. They see the stages – bottling, labelling, everything." [Teacher BB]

Thus, it is evident from the participants' words that learners discover from computers a myriad of avenues to knowledge that promote better understanding, thereby enhancing learner-centred and experiential learning. Oseghale and John (2014) assert that when computers are used in a constructivist approach, they can have substantial potential to improve consistency and quality of instruction, resulting in the development of learners' higher-order cognitive skills.

In view of all that was highlighted by the participants in relation to the salient importance of computers in teaching and learning, the researcher found that teachers perceive computers as a crucial supplementary pedagogical tool. Cuban, (2001) as cited by Kennah (2016:9), asserts, “Technology will always play a major role in the 21st century and more than ninety percent of the jobs created now will require advanced technological training. … For this generation to compete for future jobs, they must have adaptive skills”. The researcher found that those teachers recognized the vital roles played by computers, if only were consistently meaningfully used. However, irrespective of their good vision, teachers superficially used computers for instruction owing to a variety of hurdles encountered, which the researcher details under *Challenges* in section 4.2.5 below.

4.2.3 Common computer uses

Concerning ways through which computers as a tool were commonly used, the participants generally concurred that they used them for research, problem-solving, slide presentations, and to accomplish some administrative work. From literature reviewed the researcher found that most teachers expressed similar opinions: that computers are used for several purposes such as preparation of instructional material, administrative work, accessing model lesson plans, for research and for drill and practice by the learners (Bhalla, 2013).

Teacher CB asserted:

> “*I prepare my lessons; I prepare mark lists; and also if I want to show them something I just go to Google and research whatever I want to show them. Even though they are big (referring to the number of learners), I’ll call maybe four at a time to come and have a look at whatever I want to show them.” [Teacher CB]*

Respondent teacher CB basically elucidated that she used computers generally in the form of computer-aided learning (CAL), computer-assisted instruction (CAI), and computer-managed instruction (CMI). The researcher deduced that although

computers were superficially used here, she could at least do some lesson plans and mark lists (CMI), and present researched material (CAL and CAI) to her learners. Bhalla (2013) found almost the same scenario in India, where teachers were commonly found to be using computers to develop lesson plans, research updates on subject knowledge for learners, and then present researched matter to learners.

To substantiate the revelations that she always used the computers for collaboration and communication, teacher CB stated:

> *"And besides you find that our seniors, like Subject Advisers, instead of giving us hard copies, send emails so we have to get that information through them." [Teacher CB]*

> *"And then I use the computer to make the mark lists and also use the Spreadsheet just to enter the marks, type exam papers, and whatever other paperwork there is." [Teacher BB]*

Teacher BA mentioned virtually similar ways in which he used the computer:

> *"I use it for teaching… using a PowerPoint; and using a projector obviously for a PowerPoint to show learners my slides; I also use it to play videos and sometimes sounds because my lesson or my subject requires my learners to see some of the things that I am talking about. One knows that learners are different – some of them are visual learners; so for their understanding they need visuals or something that they can see so they can relate to it better, because even when I'm not using a projector, I use my computer to see the slides that I prepare for myself; I use it to show the learners the pictures, or sometimes videos. In fact for those ones who are fortunate to have their own computers benefit a lot because I sometimes share slides with them. I give them slides after the presentation. After the lesson I call those ones who have their memory sticks to come and collect the slides. Then I transfer them to their USBs, and then they'll take them to their computers so that at home they can also go through the slides." [Teacher BA]*

Bhalla (2013) comments that multimedia content can go a long way in enhancing teaching and learning because it stimulates learners and makes understanding concepts much easier. The current researcher's findings concur with Bhalla (2013) that CAL use is essential because of its multifaceted approach and current information, thus making abstract concepts more realistic. Bhalla (2013:177) summarizes use of CA thus: "This mode of instruction employs…three ways – whole class instruction; teacher-directed student assignments; teacher's self-learning." Teacher BA could just reach out to the whole class when using his laptop computer. The negative effects caused by the lack of computer resources can be ameliorated significantly through the CAL approach (Mdlongwa, 2012). Teacher AA explained:

> *"When I teach some of my lessons I prepare them on the computer; most of my worksheets are on the computer; but I use it in conjunction with a data projector; and also use some software that is specifically designed for teaching mathematics. The software that I use for mathematics is GeoGebra. That is software that enables you to enhance your teaching in drawing diagrams for geometry and graphs for algebra and graphs for trigonometry and things like that." [Teacher AA]*

Teacher AB also shared an opinion with the rest of the participants when she explained how she made use of a computer to reach out to many learners (50+) who were grappling with the problem of laziness and the shortage of English text books for learning. Shortage of textbooks was reported as the common phenomenon that wreaked havoc in her school. She explained how she tried to ameliorate both problems of overcrowded classes and shortage of English textbooks by making use of computers, specifically using the CAL approach, for teaching and learning. Concurring with the participants, she commented:

> *"With English, we've got a lot of short stories, novels and everything, but you find that some learners are too lazy to carry books; but you just make a PowerPoint for the learners and project it to them and you read with the whole class." [Teacher AB]*

In contrast, another participant teacher, CA, who happened to be the only holder of formal computer-related qualifications from the sample of six teachers, said that she could not use computers meaningfully for teaching, especially in her Business Studies class, save for CAT. Reflecting on the *scant* use of computers, owing to the lack of computers across the curricula in the school, teacher CA asserted:

> *"The only thing that I can do with my computer is to design the worksheets for my Business Studies learners and print them out. But I cannot teach using a computer. It's hard." [Teacher CA]*

Almost all the participating teachers said that they used computers for preparing lessons and mark sheets, recording marks, communicating and collaborating with their learners and/or supervisors, project in slide presentations, designing worksheets and doing basic research for the benefit of their learners. The researcher concluded that computers were generally being *superficially* used. Nevertheless, teachers indicated that they improvised, given the situation of their overcrowded classes (50+), and managed to apply CAI, which meant that they used computers for both instruction and management of teaching process (CAL, CAI an CMI) (Bhalla, 2013).

Thus the findings reveal that computers were underused in 2018. This contradicts what the DoE expected, as is enshrined in the e-Education policy, that by the year 2013 all teachers and learners, in both primary and secondary schools, would be computer-literate and be able to access and use computers meaningfully for teaching and learning (DoE White Paper 7). Mooketsi and Chigona (2014), as cited by Padayachee (2017:36), revealed that there was incongruence between what the DoE intended to achieve and what actually transpired in connection with the extent of computer technology use by the teachers in schools.

Similarly, Vandeyar's (2015:1) study shows that district officials only *superficially* understood the intent of the e-education policies, thus impeding the effective cascading and implementation of the national e-education policy at district level, which inevitably, received inadequate support at school level. The researcher concludes that the *superficial* use of computers by teachers in the sampled schools

of Pinetown District was a direct effect of ineffective communication of national e-education policy prescripts and lack of follow-up by the DoE to ascertain the effectiveness of computer usage by the teachers.

4.2.4 Nurturing learners' computer usage

Appealing to learners' senses motivates them to be more responsible for their learning, and thus active in the construction of their own knowledge. When computer tools are meaningfully used to support teaching they result in learners collaborating with peers and teachers, promoting real time self-assessment and quick feedback, and reducing learner behaviour problems during the learning process (Edutopia, 2014).

In this particular instance, the researcher elicited information on how participants encouraged learners to use computers for learning.
Generally, teachers expressed similar views – that they were grappling with a scarcity of computer hardware, coupled with exorbitant computer prices. They indicated, therefore, that the situation forced them not to encourage learners to make use of computers.

> *"In my school I haven't, because to encourage them it means I am inviting them to work with computers, only to find that I don't have those computers for them to work on, because if we had maybe at least two computer labs it would've been better because we would've tried to accommodate most learners with computer literacy just to have a basic understanding of how to work with computers; so not having enough resources does not motivate me as an educator to encourage learners to work with computers because they have to have access to them. Should I encourage them, when they're interested; what am I going to do? I would offer them facilities I do not have; so, I haven't." [Teacher CA]*

Teacher CA pointed out that she nurtured *only* her learners who were doing CAT because those were the ones who had the privilege of accessing and using school computers.

Similarly, teacher CB stressed that she could not encourage learners to use computers for their learning and assessment.

> "*I wouldn't; I wouldn't because they have no knowledge; they don't even have the computers at home; so how can I encourage them to use computers…; nooo. The school does have computers, but strictly for CAT students." [Teacher CB]*

Unlike teachers CA and CB, teacher AA gave a comprehensive description of how he nurtured his learners, encouraging them to use computers for learning mathematics. He pointed out that learners have shown lots of interest in maths, as they were given access to computers in the school to learn his subject. Referring to NGOs, he said:

> "T*hey've just engaged learners in two projects; there's a project called Siyafunda, and there's another one called ClickMaths. Both these projects are projects based on the learners using the tablet computers to learn different topics in mathematics. There's a programme that's loaded on the tablet. And currently they've two servers for the projects; and what happens is that learners come to the room and login to the tablets and they can go and do some activities, which are loaded on the programme. So it's a very interactive programme, and it gives real time responses on how they're doing in activities." [Teacher AA]*

Teacher AA indicated that the positive effects of encouraging learners to use computers showed in the interest learners have expressed.

> *"Yeah, it has aroused interest. The Grade 8s were asking me when they were coming back to use the ClickMaths, and I promised them that once they finish writing they've to come back." [Teacher AA]*

About assessment, teacher AA said:

> *"The ClickMaths has got part of assessment. Learners do an activity, and they provide answers, and the software tells them straightaway whether they got the answer correct or whether they got the answer wrong; and I always monitor it on my server as well. There are so many learners that are struggling, there are so many learners who are doing very well. These are the sections where they're struggling, and this is where they need to be, you know, drilled."[Teacher AA]*

When teacher AB was asked how she encouraged learners in making use of the computers she said that she did not *only* nurture them in the use of computers in learning maths, but also empowered them with general computer literacy, which could allow them to use computers in the learning of other subjects.

> *"In connection with learners, I always tell them that this is not just something you can use in maths, but this is also a learning process for you to be able to use computers, because there're some subjects for which you need to go on the net, and you don't know how to go about doing that. So this is also teaching you some things about using this tool in connection with other subjects." [Teacher AB]*

Generally, teachers said that they could not encourage learners to use computers because of the shortage of computer resources and lack of electricity in their schools. Challenges which inhibited the smooth use of computers were the topics about which teachers talked at length in the subsection that follows.

4.2.5 Challenges, stakeholder support and suggestions

All learning institutions have their own challenges as they endeavour to achieve their organisational plans and set goals. The researcher strongly feels that, as challenges surface, stakeholders should scrutinize them, understand them, and solve them

forthwith, taking cognisance of pertinent suggestions put forward by the implementers of e-learning and ultimately national e-education policies. In this section, the researcher begins by systematically analysing the *challenges* revealed by the teachers, and then wraps up with a systematic analysis and interpretation of the subsequent *stakeholder support and suggestions*.

4.2.5.1 Challenges

This part of the analysis is concerned with the challenges faced by teachers in trying to meaningfully use computers to enhance effectiveness and efficiency in secondary schools. The rationale was based on the view that computers could promote the proper design and use of teaching and learning materials which are effective for authentic instructional purposes. Computers are assumed to play a pivotal role in grading appropriate standards for learners' academic achievements, thus complying with the requirements of skills development in the digital age (Salehi & Salehi, 2012).

However, a plethora of challenges were found to hamper the proper use of computers so as to add value to the education system in our secondary schools sampled for the purpose of this study. Padayachee (2017) has found that some pedagogic, operational and strategic challenges have prevented computer technology from being integrated effectively in the teaching and learning in South Africa. The researcher has also been left with no doubt that poorly equipped e-learning district officials cannot render any meaningful support to teachers trying to implement e-education policies.

The researcher has defined challenges as barriers or hurdles that inhibit teachers in using computers effectively. Participants highlighted the following as some of the barriers that inhibited them from effectively using the computers for instruction: biased use of computers in favour of Maths and Sciences; rampant thieving of computer resources; lack of electricity in the classrooms; lack of access to computers, and/or computer shortages; little or no access to Internet facilities; lack of clarity on the computer use requirements of the Annual Teaching Plan (lack of a

clear sense of direction); lack of computer competence among the teachers; and lack of stakeholder support.

Bhalla (2013) also identifies some of these challenges like *scarcity* of computer resources, *training* and support, and teachers' *confidence, beliefs and attitudes*. In this study, the researcher found that *skewed use of computers*, *irregular use of computers as a tool* and *rampant thieving of computer resources,* constituted the *three* umbrella challenges commonly revealed by the participants, under which some minor ones, such as lack of electricity, acted as catalysts.

These barriers were addressed with the aid of some supporting quotations from the participating teachers on their comments in semi-structured interviews. Corroboration of pictures taken by the researcher was also used to further substantiate challenges being faced in the schools investigated. Interpretation of the challenges was also done taking cognisance of the literature reviewed.

4.2.5.1.1Skewed use of computers

The findings from all the sampled secondary schools reveal that the computer as a subject was made available *only* to computer application technology (CAT) learners. Computers are used to teach learners Office packages like Microsoft Word, Excel, PowerPoint and Access. This was found to be common in all the sampled public secondary schools in which use of computers was found to be *biased* towards CAT studies at the expense of the rest of the seven subjects constituting the FET areas of specialisation, such as Commerce, Humanities, Languages, etc. Learners would write final CAT external examination in Matric, which meant that they were the *only* learners who would officially be recognised to be computer literate after the Grade 12 year cycle, as the rest of the learners were not even allowed access to these computers in their schools.

Giving a description and explanation of what she did with computers as a tool in CAT, teacher CA, who teaches Business Studies, asserted:

> *"I'm teaching Computer Applications Technology, which means we are specialising in the application programmes, that is, Microsoft Word, Microsoft Excel, PowerPoint, Microsoft Access, which is the database. We have*

introduced the new programme, which is the HTML (Hyper Text Mark-up Language) that has got to do with the designing of websites. So that's what we are dealing with in computer applications. There is a practical part, and there is a theoretical part, because before the learner starts working with the computer he/she should know what the computer is in the theory part." [Teacher CA]

Teachers and learners felt divided and being denied the chance to use the few computers in their schools, which further indicated an overwhelming bias in computer uses in their schools. This level of skewedness was revealed by teacher CB when she briefly asserted,

"The school does have computers, but strictly for CAT students". [Teacher CA]

Scrutiny of the subsequent quotations revealed conspicuously that *bias* also appeared in the use of computers only for specific '*special'* subjects like mathematics, sciences and Engineering, Graphics and Design (EGD). Findings reveal that the teachers of those subjects had the privilege of being trained, given laptops and teaching *only* their learners, using computers as a tool.

In fact, some donors were found to be playing a pivotal role in advocating the use of computers in maths and sciences, as they donated computers and tablets *only* configured with specialized maths programmes to enhance subject content delivery in the aforementioned subjects.

"The ones that I am using currently are a programme called Kasme and also ClickMaths. I was also part of it when I was in high school. They provide learners with tablets – those who're doing maths, not all learners. It's a donor organization which is more concerned with the learners who're failing maths. So right now they're trying to introduce new technology whereby learners will be able to adapt in mathematics more easily and be able to enjoy it." [Teacher AB]

Teacher AA revealed that mathematics learners are *privileged* because they are given a learning environment where they use donated computers and specially programmed tablets *only* for learning mathematics. The tablets do not have WhatsApp programme applications and cannot send or receive calls, so as to avoid learner distraction from the core academic work planned.

> *"They've just engaged learners into two projects. There's a project called Siyafunda and there's another one called ClickMaths. Both these projects are based only on the learners using the tablets to learn different topics in mathematics." [Teacher AA]*

Presumably, what teacher AA asserted could be so disheartening to other learners not doing mathematics and sciences subjects that they inevitably become disengaged, and could ultimately fail to achieve their intended academic final results.

> *"The maths and science departments are the ones which are always going to those workshops, whence they'll come back with the laptops. They're always trying to improve the science department and forgetting about the other departments. And they've created this stereotype with learners that if you are not doing maths and science you are not smart enough; and the learners who are doing maths and science are always given more opportunities than the others." [Teacher AB]*

In the literature reviewed the *bias* referred to was also revealed in Western Cape, where the Khanya (MasterMaths) project was *only* meant to improve mathematics results in the Matric external examinations (Smith & Hardman, 2014) at the expense of the rest of the curricula. The revelation of incessant biased use of computer technology was not a surprise to the researcher because the DoE's assumption was always that inculcation of computer tools would mitigate failure rates in maths and sciences, paying more attention to historically disadvantaged rural schools (Ndlovu& Lawrence, 2012).

The limited research in the use of computers as a tool to improve a few "special" subjects, ignoring the rest of the secondary school curricula, was one of the topical

issues that prompted this study, because that phenomenon indicated a gap that necessitated more profound and general research into the use of computers across the curricula. Apparently concurring with the researcher, Padayachee (2017:37) notes: “Clearly, studies that consider the depth and breadth of the actual usage of digital tools is lacking”. In correspondence, the current research has revealed the same unfortunate phenomenon still manifesting in the sampled secondary schools in Pinetown district as is evidenced by the participants highlighting Siyafunda and ClickMaths projects meant *solely* for mathematics.

The then Minister of Education, Ms Pandor, announced that new learning opportunities were being opened through the dispensation of new technology, making more diversified and current educational resources available to both learners and teachers, thus promoting favourable networking and collaboration, and ultimately stimulating authentic learner academic achievement. (Department of Education, in White Paper 7, 2004:6). The Minister appeared ‘silent’ and never alluded to the fact that currently there would be still such a bias towards the use of computers as a tool in mathematics and sciences, as is revealed by this study.

Making reference to the ANC manifesto in the *Mercury* newspaper of January 16 (2019:4), about an article entitled “Long Way to Go to Implement e-learning”, Bongani Nkosi postulates, “Communications Minister Stella Ndabeni-Abrahams told journalists on the sidelines of the ANC manifesto launch in Durban that the government intended to drop the chalk board for e-Learning,” This wish contrasted squarely with the DBE data, which revealed that schools in the provinces with vast rural communities have low internet access, indicating that thousands of learners would be *left out*(*The Mercury*, 2019:4).

The participating teachers expressed no overall meaningful DBE involvement in its computer projects to ascertain the effectiveness of computer tools for teaching and learning in the secondary school curricula. The researcher strongly felt that the phenomenal bias in computer use in the sampled secondary schools was a direct result of the DBE not making a comprehensive evaluation of the extent to which the computers distributed were used. Substantiating this neglect, one respondent said:

> *“But they did make the follow up this year, just of ‘one day’. How far? They just came to check ‘how far we have gone’. How far have we gone,* ***where****? It was*

just that day. Most of us found out that it was just ***one*** *lady who was able to work with these (Hospitality configured programmes) because at school (that other teacher's school) she has got access to computers. Even Indians, even white people had a problem. Yes! Not only the black schools." [Teacher BB]*

4.2.5.1.2 Irregular use of computers as a tool

This was one of the *worst* challenges revealed by participants, which was caused by some various problems characterizing the school management and use of computers in the schools investigated. According to most teachers, *irregular* use of computers was caused by lack of *vision* on the part of the SMT (one of the most glaring problems), lack of *electricity* in the classes, *scarcity* of computers and their accessories, lack of broadband access for *internet* connectivity, waste of time *moving* computers to and from strong rooms (safes) to avoid their being stolen, and by donors who usually donated specially configured computers for compatible use only with mathematics and science.

"Another challenge that I have or that I've just observed: it's a lack of vision, I would say of the management, because the management of the school is the one which should make the institution up and running. I do not know whether it's because they do not understand the subjects. They do not know the importance of working with computers. We need upgrades now and again. So when we communicate with our management, telling them we want to upgrade our systems, then you find it very hard. You'll find that they'll even suggest that the subject 'close' because it's hard to maintain and stuff; that's another challenge. You see, when you are a teacher you 'bond' with your subject, you love your subject, and you wish you were in control of your subject. Unfortunately, as computer teachers we do not have overall control of our subjects because we are dependent on the management to ensure that our subject goes on." [Teacher CA]

Teacher CA cited sound reasons that led her into using the computers irregularly, such as being *frustrated,* and *threatened* that the subject should be deleted from the

curriculum. Such archaic and autocratic leadership approaches instil fear in teachers in such a way that they end up not informing the management of the necessary changes and upgrades that have to be adopted to ensure regular and effective computer usage. For fear of exacerbating the situation, teachers would just take a passive stance, fearing for the security of their jobs, because when they openly inform their SMTs of the latest required upgrades, they are told that their subjects would be better "closed". Almost the same challenge of SMTs' lack of vision was revealed in Kenyan secondary schools. Omariba, Gitau and Ayot (2016:3134) assert, "The major challenges teachers expressed as impeding their effective use of instructional technologies were…rigid administration in providing storage facilities and the suitability of the instructional technologies to suit topics being taught."

Concurring with teacher CA, teacher CB expressed dismay at the *laissez-faire* attitude of the SMT towards the teacher's requirements to ensure effective and regular use of computers in her subjects (Travel & Tourism and Consumer Studies). Teacher CA indicated that she carried her computer to work every day so that she could work on it *whenever* she was free and available. This showed that there were no regulations for using computers in school C, as she clearly stressed that she used her computer to do *"whatever"*, hence irregularly."It is clear that the challenge not only lies with how to use the technology but also lies with how to integrate digital technologies into the curriculum", vehemently comments Padayachee (2017:57). Subsequently, teacher CB asserted:

> *"There's a problem; no one really cares if I can put it that way. If the school cannot provide, you use the money out of your pocket. That is what I always do; it is very hard indeed. I always complain about it. Sometimes you find out that I make copies of 16 pages; and how much pages is that at R2 each? And not once per week – it's really costly…I always carry my laptop every day. It's even there (in her class); if I've a 'free' period I just sit here with my computer doing 'whatever' I want to do. … Clearly, I would say, the problem is when you want learners to do some kind of research. I cannot bring my laptop and give them my internet access and say, 'OK, go there and Google,' because at the end of the day I do pay for that." [Teacher CB]*

Teacher CB expressed serious concern about the problems she encountered, by *deliberately failing* to give her learners some practical homework, which needed to be researched on the computer, citing the problems of computer *illiteracy* on the part of her learners. Given these challenges, *irregular* use of computers seems to become inevitable.

> *"And nowadays, really I find it very difficult to teach and even learners to do this kind of technology because they've to go and research, but they don't know; they've no experience at all; they don't even know how to type just simple things. … Even if you say "Go to the library; go to the Internet." you just, eish!" [Teacher CB]*

Very little or no computer hardware was the other major problem highlighted by the participating teachers, which resulted in their not having access to computers, thus inhibiting their regular use of them for teaching and learning. Teacher CA explained that she wished to use computers in teaching Business Studies, but because of the *scarcity* of computers in the school, she could not. Showing signs of *stress* as she expressed herself, teacher CA asserted:

> *"I wish it was possible to use it as much as I would like to, but it's impossible because of the scarcity of resources. Let me start by saying the number of computers are not enough to accommodate most of my learners. The school has got only **two** computers. But my BS (Business Studies) learners, 10C I've **60** learners, and in 10F I've **58** learners; so it is impossible to work with computers when presenting my subjects. But even though there are other means like using the projector, it was **stolen**. So I can't. So meaning it's impossible, I can't do." [Teacher CA]*

From this quotation the researcher was strongly convinced that, given a situation of having only *two* computers in the whole school, *overcrowded* (58 to 60 per class) classrooms and grappling with rampant *thieving*, the teachers could not possibly plan and use computers regularly.

Teacher BB highlighted that when she gave assignments she noticed some worrisome signs of how learners' work could be *irregularly* done owing to some learners failing to have access to computers for researching and typing their work.

"*Some (learners), when I give them projects, bring typed work, showing that they have downloaded or typed something. Maybe you'll find that it's just one or two, and then the rest are in longhand." [Teacher BB]*

Citing similar challenges experienced by the teachers, which were alluded to by teacher CA, teacher BA said:

"We've got a problem that most of our schools, especially this one (school B), are under-resourced in a way that you don't understand, because I don't think that they're 'under-resourced', but they are. You find that the whole school, with an enrolment of about 1500 to 2000 learners, has about three computers, or two, or even one working computer. If there are three, you'll find there is 'no charger'. One then is compelled to buy one's own. So that is why I bought my own computer specifically for teaching. So I use mine every day, which gives me time. I go with it home so that I can prepare the slides. I prepare presentations at home so that I come with them. I even added a projector." [Teacher BA]

Irregular use of computers became more apparent, in the above quotation, as teacher BA, with *only* four years' teaching experience, was compelled to buy his own, together with the projector. He could prepare his teaching slides at home, which could imply that not *all* teachers do the same because it is not enforced and regulated. Computers could –and should –be used regularly across the curriculum for authentic teaching and learning in this digital era. Teacher BA teaches history, but mathematics and sciences are regarded as "special", hence are taught using *donated* computers.

Irregular use of computers was further witnessed in the sampled schools when teacher AA, having been asked if he had seen all other teachers using computers for teaching and learning, responded:

"Yeah; yeah; there is the History guy. He uses slides presentation for 'some' of his lessons; and I've seen the LO guy using slide presentations as well. Yeah. Who else? Yeah, that's basically that…but internet connectivity is an issue, so I depend on my smart phone for internet connectivity." [Teacher AA]

Teacher AA indicated deep concern that computers were not used regularly by educators because of lack of access, as they are *scarce*. He added that teachers

have a *negative attitude* and *lack intrinsic motivation* to use computers in their instruction.

> "*Yeah, I think it's limited access. We're 50 educators in school, and there are four or five laptops available. So, you see, one of the most important things. You can have the entire infrastructure that you need in the school, but you must want to use it. You must want to use it. I can tell you the amount of money that I spent on my own gadgets that are not provided by the school, because I want to use them."*

To emphasize the challenge of *irregular* use of computers, owing to some classes having electricity and others not in the sampled schools, four of the six participants expressed similar electricity challenges. Teacher BA stressed:

> *"You know the biggest one, the biggest one is, electricity. Not really electricity, but because some classes do not have plugs, it means you can't use anything beyond a laptop to show the learners, and you'll have to move around the class to show them if it is a picture, which consumes a lot of time. Then sometimes it'll compel you to sometimes neglect the computer, going back to an ordinary way of teaching, the traditional one. That was the biggest challenge that I encountered, not only just in this school but in the other schools as well where I've been. They hinder us from using the computers as much as we want; then you'll find that some learners will complain: 'Sir, you are teaching the other classes using a computer; why not us? What did we do to you?' Then it will appear more like you are compromising them purposely". [Teacher BA]*

The participants reported that some of the classrooms were not having *electricity* to allow regular use of computers because they had no sockets where they were supposed to connect the computers and data projectors.

> "*The infrastructure in the school doesn't allow us to use like, for an example … I can only use the tablets in the laboratory because not all the classrooms have got electricity. So another teacher wants to use a data projector in the classroom; and there's no power. Not all classes have got sockets". [Teacher AA]*

Teacher AB pointed that their learners ended up perceiving them as being unfair teachers as they could only present slides to learners whose classes had sockets, compromising those whose classes had no sockets.

> *"The challenges that am having in the current school in which I am is that some of the classes don't have electricity; they don't have plugs; so it's unfair to learners if I were to do one thing for some learners and not for the others, unlike in maths where we've a lab where we teach them."[Teacher AB]*

Apart from the schools not having electrical sockets in classrooms, one of the most experienced participants expressed serious concern that since her arrival at the school the SMT *seemed not to care* about the problem of electricity: no sockets; live wires in disarray posing danger to learners of getting *electrocuted*; laptops *running out of power* in the middle of a lesson, resulting in the lesson coming to an *abrupt halt*; etc. The researcher also took pictures of the vandalised sockets to substantiate the reliability and validity of the findings. The researcher found that computers were inevitably used *irregularly* in these schools because of the electricity problem.

> *"The classes are not conducive to showing these computers in class or using laptops in class. Some don't have electricity. Although there's electricity at school, the socket outlets are not working. The wires are just in disarray, and they're so dangerous."*

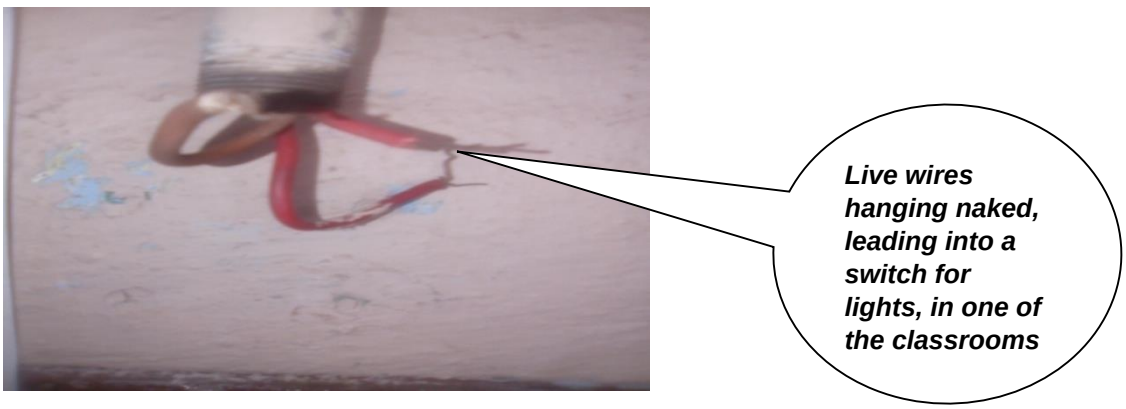


Figure 4.1: Vandalised switch & socket. (Picture taken by the researcher on 2018-10-24)

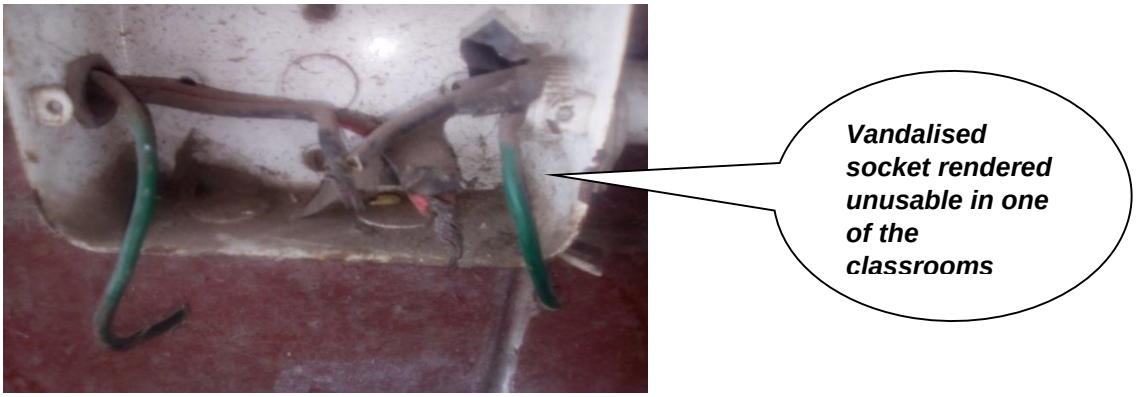


Figure 4.2: Open socket area –naked electrical wires

> *So it's easy for the learners to get shocked … if I bring this (her laptop) to class I've to charge the battery. Irun it, and then find it is getting depleted. … Where am I going to charge it? Which means the lesson comes to a halt. I once reported it at the meeting. 'Yeah, we'll have a look at it; we'll have a look at it.' That's all. Ever since I arrived in this school (2007) it's been like that."[Teacher BB]*

The above pictures were taken by the researcher to substantiate what the respondent teacher BB revealed with dismay, indicating how dejected she eventually felt owing to the school management "deliberately" failing to attend to such pertinent issues.

Having no computers at home leads to *irregular* computer usage by the learners. The respondent teacher CA indicated that, because some of her learners did not have computers at home so that they could continue with some homework, she was forced to optimise and work with her learners after contact time, which was only *one*hour per day. She stressed that therefore she was *forced not to* give learners practical homework, meaning that learners were having more theoretical work than was necessary.

> *"Regarding the learners…most of our learners do not have computers at home; so they are using computers here, only in school; so it becomes a problem as well because it's hard to give a learner homework that is practical, because the only practice the learner will have is here at school, which is hard. The only 'hour' that we have does not cover what needs to be covered with practicals; so we go an extra mile by having extra classes and so on; so that is another challenge." [Teacher CA]*

Irregular use of computers was also evidenced owing to time wasted retrieving the computers from the '*safe'* place, the principal's office in school C; transporting them to the computer laboratory, then *unpacking* them for learners to start learning. Learners are compelled to pack them in their original boxes *before* the lesson ends so that they can take them back to the 'strong room' in the principal's office. The researcher, observed that during a 60 - minute session of computer practicals in CAT, 10 to 15 minutes could be lost in transporting, and unpacking computers so as to use them, and then packing them back into their boxes before they could attend the next lesson.

To ascertain what was actually happening, the researcher posed a question as to why learners are seen carrying computer boxes to and from the office every day. In her response, the CAT teacher revealed:

> *"They don't stay in the lab. We keep them in a safe place because of the experiences we have had where there were break-ins and stuff; so we just carry them to class when the period has to start; unpack them, and when we are done, we have to pack them back again at that safe place. … Usually if am free in the morning I'll make sure that I collect the computers before time. Before they (learners) arrive, the computers are already here, and then I unpack them and wait for the learners to come and learn."[Teacher CA]*
>
> Her quoted account shows that the participant used computers at the regulation starting time only when she happened to be free a period before her actual lesson started that day. The observed reality, according to her timetable, was that she was not always free a lesson before her CAT lessons could start, which inevitably meant that she used computers irregularly most of the time. The lesson started late when she was not free. Unequivocally, this scenario translates into an inevitable *irregular* use of computer tools.

Irrespective of this hurdle, the researcher felt that teachers also irregularly used computers owing to their negative attitude towards the technology itself. In line with the literature reviewed, Mikre (2011:12), and Oladosu (2012), as cited by Mathevula and Uwizeyimana (2014:1090) assert that "teachers' attitudes play an important role in the teaching-learning process that utilises computers and Internet connections." Mathevula and Uwizeyimana report that teachers said they resisted accepting use of

computers because they feared that they would risk losing influence over the nature of classroom activities, which would presumably be viewed as lack of competence in using a computer, coupled with the SMT's lack of vision about computer usage.

4.2.5.1.3 Rampant theft of computers resources

Rampant theft of computers has been identified as the most gruesome challenge wreaking havoc in those sampled secondary schools under study, which cascaded into other challenges such as irregular use of computers, and even threats to close subjects like CAT, which could not go on without "enough" computers being available. In a nutshell, theft of computers scared away donors; resulted in computer shortages, which forced some schools to issue threats to discontinue CAT subjects; resulted in *irregular* computer usage; further entrenched the digital gap between the elite and public schools; and retarded the development of human capital in accordance with the requirements of the digital era (the 21st century).

All six participants said that theft of computers in their schools has taken their schools aback:

> "V*andalism is a challenge, because it's hard. We had 25 computers, and all of them were stolen. It then became very difficult for me as an educator to teach; so I've no idea of what needs to be done in terms of teaching the community about not interfering with the property of the schools because it disadvantages their kids. But when you look at how these break-ins happen you see that somehow it's inside info. So even our kids need some kind of education to know the importance of their assets, how to take care and not to allow to misuse or intervene. That is the first challenge." [Teacher CA]*

After the computers were stolen, Ithala bank donated 20 more, which were stolen before they were even used by the teachers and learners. Teacher CA expressed her dismay about theft in her school:

> *"So the Ithala bought computers for me; I think we had 20 computers. We were using the lab up there. They stole those computers, all those computers (20 of them); they, they broke in there. And it's worse there. It's much better in*

here. The room that we were using, it's like, you know a classroom; just a classroom which has got nothing, no burglar guards, nothing. So they just took all those computers; and then the Department gave us these 25 computers, and mind you, as you can see, these extensions (pointing at cut network cables) were networked. The centre was networked, and then they broke in here; they stole all these computers" (second robbery). [Teacher CA]

NB: Witness pictures below where criminals went through the roof to steal computers.

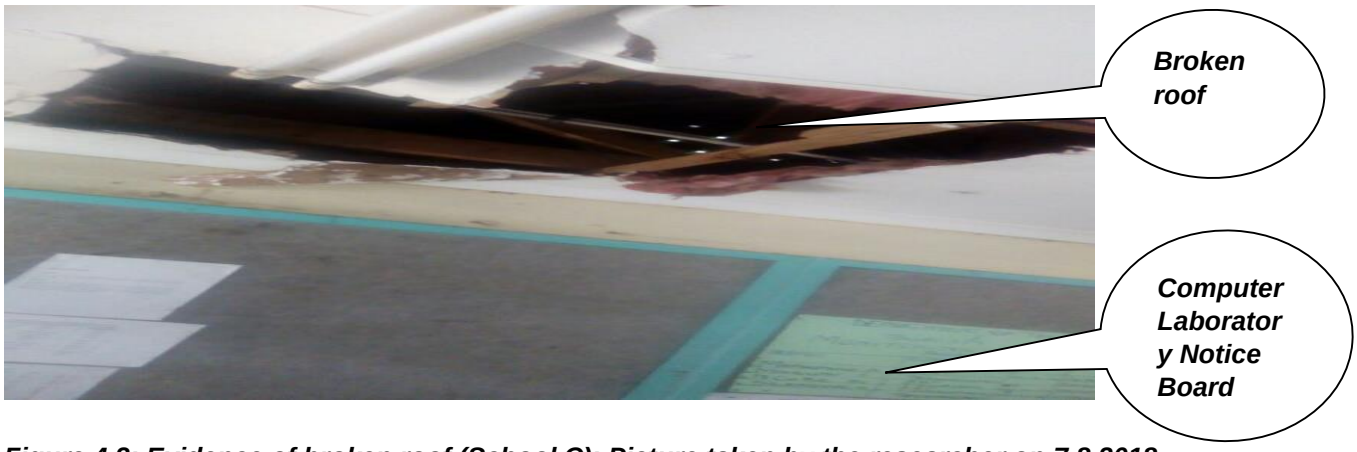


Figure 4.3: Evidence of broken roof (School C): Picture taken by the researcher on 7.8.2018.

Below is the picture of the idle computer monitors that were left behind after criminals stole all upright Computer Processing Units (CPUs).

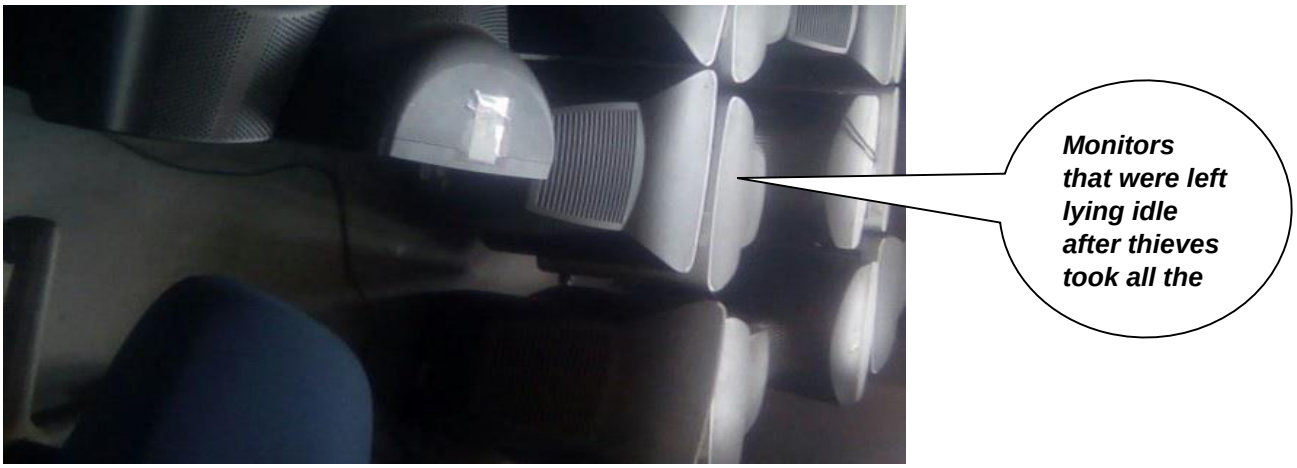


Figure 4.4: Idle monitors. Picture taken by the researcher on 7.8.2018.

Teacher CA continued narrating the theft incidents in her school:

> *"And Vodacom gave us the tablets; they came for tablets (third attempted robbery).Fortunately, we realised before they took them out, but they opened that case. In fact we were alerted by a learner. We do not know whether the learner had knowledge or but at least he gave us warning. So we took out the tablets and the principal has kept them* (researcher probes). So the tablets are there in the school, and they are kept by the principal. What purpose are they serving there? *None! In fact the principal said he would beef up the security in this room (**see Figure 4.3 picture above**), for which we are still waiting." [Teacher CA]*

Teacher CB expressed similar pain about thieves wreaking havoc in their schools. Coupled with the theft problems was the ineffective communication within the schools, which seemed to harden the teachers' spirit against using computers for instruction.

> *"Some years back there were some computers; I don't know who sponsored them, whether they came from the Department of Basic Education or a company; but I was told that it was for teachers to use that centre to do schoolwork. But they were stolen, even before we were really informed officially, 'Now, teachers, you can use these computers. It was not like they were stolen the next day; maybe it was a couple of months. But because there was this someone who is like "It's mine, it's my thing, it's my thing, you know!"And then when they got stolen, that's when we were told the computers were stolen. Yes. But we were never told officially." [Teacher CB]*

Almost similar challenges of theft of computers, which made regular use of computers so difficult in schools C and B, were also highlighted in school A.

> "*The biggest problem, in the school, is safety; the safety of the computers in the school. So at the moment I always take the tablets with me home; and every time I take them home and bring them with me back to school because I feel it's not safe to leave them here in school because the offices Rooms have been broken into several times, and there's quite a lot of computers that have been stolen; more than 30 computers were stolen from the computer*

room; yeah; so safety is one of the biggest issues; the biggest, biggest challenge." [Teacher AA]

As these quotations have made clear, findings indicated that the biggest challenge the schools were facing was lack of *safety* of computer resources. Schools were really struggling with *safety* problems. The DBE supplied computers and NGOs donated them to these three secondary schools in Pinetown, rampant theft proved to be the common phenomenon hindering them from using computers regularly.

The theft of computer resources was recently found to be wreaking havoc also in the Gauteng province of South Africa. The *Sowetan* newspaper (16 January, 2019, p. 1) reported that Menzi primary school in Tsakane, Ekurhuleni, was *"wiped"* of all of its state-of-the-art technological resources: all the computers and over 180 tablets. The researcher strongly felt that the surrounding communities needed effective educational awareness programmes so as to be watchful of theft problems robbing their children of bright an competitive future lives.

The major challenges discussed above are: use of computers skewed in favour of CAT, maths and sciences; irregular use of computers owing to lack of computer competence on the part of teachers; blurred alignment of e-Learning policy requirements and the general school curricula; lack of time to use computers in the classrooms because it is not compulsory in the Annual Teaching Plan; and rampant theft of computers in secondary schools. The findings revealed that theft was the *worst* challenge, which cascaded into shortage of computers and ultimately irregular use of computers as a tool for teaching and learning across the secondary school curricula.

The following subsection analyses information on the kind of support and suggestions required to solve the above highlighted challenges

4.2.5.2 Stakeholder support and suggestions

Policies of the DBE such as e-Education (White Paper 7), are vital to give teachers informed direction. For teachers to use computer tools to deliver the curriculum, they need stakeholder support with vision, and SMTs who are proactive and knowledgeable about e-Education policies and challenges facing teachers. In a study

to investigate how well equipped the district and provincial e-Learning officials were to effectively implement national e-education policies, Vandeyar (2015:21) that "schools were implicitly informed by what the policy states and not inducted into how the policy should be implemented into teaching and learning". That omission is a symptom of lack of stakeholder support. Vandeyar (2015) found out that e-learning officials perceived themselves as mere "conduits" for dissemination of policies to schools, which created serious challenges for teachers who were eventually expected to implement policies without a clear sense of direction. This scenario means that no meaningful support was extended to the teachers, so they used the supplied computers superficially. Failure to get proper support in terms of training and induction resulted in teachers using computers for anything they thought would increase their job satisfaction. Thus teacher CB was quoted above as saying: "*I always carry my laptop every day. It's even there; if I've a 'free' period I just sit here with my computer doing whatever I want to do."*

Virtually all the participants revealed that they were *unsure* of any tangible support.

> *"None whatsoever. Because I've got my own laptop it does not even look as if I am being appreciated for making an effort to buy my own so that I make my job so easy, and to expose my learners to such information, it's not easy. I don't know how to put it, but most of the time I use money to print. The printer is there, but it's kind of like you've to beg and kneel in order to have access. … I've never heard any parental involvement in terms of them wanting to improve; no support." [Teacher CB]*

Teacher BA vividly expressed the point that he had not received any stakeholder support, which compelled him to buy his own laptop and data projector.

> "T*o be frank, one has never received any support from any of the stakeholders mentioned in the question, including the teacher unions themselves. One has not been assisted enough, if at all; but specifically in my case I haven't been supported at all. It seems as if people in these structures, these stakeholders, do not understand in any way the importance of using ICT or using technology in the classrooms. They do not understand it. You see even the way people are looking at you; they do not know what importance this has for the lesson*

and the learners themselves. So one hasn't received any support at all; the environment is not favourable – no computers, no support, nothing. So it's very sad, very sad." [Teacher BA]

Teacher AA, who is a member of the SMT, gave a *contrasting* view to the ones given above about the stakeholder support he had seen:

"*Yeah, the DoE gives technical support. For example, we've got a guy who's based in our circuit who gives technical support in terms of software updates, and if there are any issues with computers we can always call him to come and assist with what the problem is. He's quite useful. The SMT is very supportive, but it can only do so much because buying computers becomes very expensive; there have been some projects that the SGB has tried to help with – raising funds to buy computers and things like that. But there's not much that the SGB has done in terms of IT." [Teacher AA]*

Teacher AA used a lot of "eehs", which somehow indicated that he was reluctant to vent on the support that teachers needed to receive from their SMTs. The researcher concluded that that was the reason he declared that SMTs and the DBE were very supportive. He was the *only* participant who gave a contrasting perspective in this regard. However, teacher AA concurred with the rest of the participants that training teachers on computer use was needed to ensure their best use in secondary schools in Pinetown District.

In the light of the computer training support extended to him by both the DBE and the then school principal, teacher AA commented:

"And we were taught computer literacy at the colleges; and I've done one more course when I was teaching; I was sponsored by the DoE and the then principal appointed me to go and attend that course." [Teacher AA]

The researcher *assumed* the support teacher AA enjoyed was because he taught mathematics, and as an SMT member he got that favour extended to him by virtue of his position. This again reflected the *bias* towards the training of maths teachers, and further perpetrated through distribution of and access to computer tools in the public secondary schools such as those under study.

Overall it was generally agreed that teachers were not getting enough computer training support. Ngwu (2014) stresses that if teachers were strongly supported with computer in-service training and ongoing workshops, they would integrate computer tools for authentic teaching and learner performance, and ultimate learner academic achievement.

In view of the hurdles preventing teachers from effectively using computers as a tool for teaching and learning, teacher AA briefly suggested:

> *"Training, training, and training. I can't stress that anymore. And educators need to be trained and provided with the tools: for example, laptops, data projectors; and there're so many gadgets that are available for use by educators; but the biggest problem is being able to use whatever is being provided; so that's what I was trying to say when I was saying training, training, and training." [Teacher AA]*

For computers to be used often by all teachers, not only in her school, where she enjoyed, as a maths teacher, being allowed access to computer resources, teacher AB proposed that opportunities be equally extended to all subject departments. Padayachee (2017:36) states: "It was found that teachers are uncertain with respect to the enforcement of e-education while being encumbered by poor infrastructure and lack of skills." The researcher presumed his words to imply that teachers in the area under study lack knowledge and skills on when and how to use computer tools for instructional purposes.

Teacher AB suggested:

> *"If we had a three-month workshop in maths and sciences, and came back with laptops, the Department of Humanities should also have the same thing. We could use the computers and have our own projectors to project our PowerPoint to the learners instead of writing those notes." [Teacher AB]*

Teacher AA went further to suggest the kind of stakeholder support he felt was needed to ensure meaningful use of computers in schools. He emphasized:

> "*Yeah, there's a lot that needs to be done in terms of integrating technology into learning.* ***One****, as I said to you before, is training, training of educators.* ***Two****, is providing enough security in all schools so that if there's infrastructure*

that's been bought in the school it's not going to be stolen. And the teachers need to be told that we're living in the world of digital technology; and most things nowadays will be done digitally, and some of the teachers are not realising that in years to come learners won't need to have textbooks in front of them; maybe they'll be served by gadgets." [Teacher AA]

The researcher deduced that teacher AA's suggestions concurred with the extract from the 2019 ANC manifesto published in *The Mercury*(2019:4)*:* "The government intended to drop the chalk board for e-learning", The same article mentions that "only 28.8% of the public schools in Kwazulu-Natal…have access to the internet."

In light of the challenges and lack of stakeholder support he experienced in the school, teacher BA made the following suggestions:

"*It all lies in the resources. I think if there are resources in the school, that is, whiteboard, projectors, enough projectors, electrified classes whereby each and every class has got electricity, every teacher would want to use technology, would want to use a computer. Because, it's not that they don't want to – it's because there's a lack of resources; so if there could be resources around the school, i.e., computers, security features, obviously to protect such computers, electrification, it's what I am going to keep on mentioning because it's the one thing hindering the integration of technology in the teaching process. So the resources are the main issue here. Perhaps the Department also, after distributing or before distributing the resources, must make sure they workshop all the principals, the SMTs and the Governing Boards about the importance of such things, of computer technology, so that they appreciate and value the importance of these things in the room environment. Perhaps once they can appreciate that, the Governing Boards may be able to take school funds and direct them to the buying of resources and support for teachers who are not well equipped when it comes to the use of technology. Perhaps most resources can, therefore, be directed to that purpose once the people are aware of its importance and how it makes teaching very easy." [Teacher BA]*

From what teacher BA clarified above it was obvious that teachers generally lacked support in terms of *training*; they did not have sufficient access to computer

resources, i.e. there was a scarcity of resources in all four schools; computers' security needed to improve; and SMTs and SGBs needed some *educational awareness programmes*, which could motivate them to make informed decisions when buying computer resources for their schools.

Highlighting some intervention suggestions, in concurrence with teacher BA, teacher BB added:

> "*As I've said, we need to be taught basic computer skills; classes must have proper electricity running; schools must have internet that is accessible to each and every educator, so they don't have to use their own data out of their own pocket; so yeah, I think that's all; computers supplied by companies shouldn't be strictly connected to the companies to help them supply or donate computers. So these companies, when they supply … make it a monopoly of some sort…basically programmed to help their hospitality. And then also computers that are available at school should be available to all learners." [Teacher BB]*

Teacher BB's quotations resonate with teacher AA, and clearly reflect that teachers lack computer literacy, which, coupled with the problem of lack of electricity in some classrooms results in inefficient and irregular use of computers. The findings about superficial use of computers in secondary schools were not at all surprising because teachers stressed that training of teachers in computer usage could evade the aforementioned challenge avoid that problem, which presumably meant that most of them were computer-illiterate. "Teachers in schools need competence and innovativeness to maximise the potential of digital devices if their use will improve thinking skills that are a significant component in enhancing learner performance", (Nlovu & Lawrence, 2012:1).

The findings also revealed that teachers were paying dearly to access the internet, hence they suggested internet connectivity be improved in schools. Teacher BB suggested that donors should configure computers they donate in such a way that such computers would be usable across the secondary school curricula, and stop stipulating that they be used *only* in the subjects of their own interest.

4.3 SECTION B: LEARNERS' VIEWS ABOUT THE USE OF COMPUTERS AS A TOOL FOR TEACHING AND LEARNING PROCESSES

Specifically, this section systematically analyses and presents data that was sought through semi-structured learner focus group interviews carried out with 30 learners from the four sampled secondary schools in Pinetown District. To maintain the anonymity of all the learners who participated in the study, and to adhere to the ethical considerations highlighted in Chapter 3, the researcher coded each learner according to the school, followed by the grade and lastly a letter of the alphabet such as Learner C10A or A11D, as was detailed in the introduction to this chapter. The themes extracted were meant to address objective 2: to explore learners' views about using computers as a tool in teaching and learning in secondary schools. The researcher came up with the following themes:

4.3.1 Computer usage in the learning process

4.3.2 Frequency of computer usage by learners

4.3.3 Computer usage: an enhancement towards learning

4.3.4 Learner challenges, stakeholder support provided, and suggestions

4.3.1 Computer usage in the learning process

The majority of the learners from both Grade 10 and Grade 11 indicated that they had used computers in a variety of ways to enhance understanding of their subjects. As was mentioned in the review of literature, Llomack (2008), in his studies in Finland, observed that learners viewed computer usage as essential because they made meaningful changes in their learning values and attitudes in accordance with current job market requirements. The OECD (2015) explained that computer usage promotes experiential learning as it facilitates hands-on and collaboration amongst them, thus promoting learner-centred tactics in teaching and learning process. The researcher feels that if computers are used across the secondary school curricula, learners will inevitably achieve good academic results that may help them compete in the Fourth Industrial Revolution World of work.

> We had declared…that the challenges presented to us by the 4th Industrial Revolution, would require an altogether new paradigm for the Education system… We are on the cusp of a world where artificial intelligence, cloud computing, robotics and the internet of things are becoming the new order of business in our businesses. (Lesufi, 2017:1)

In spite of the vital role played by computer usage in learning, learners voiced, with dismay, revelations similar to those of the respondent teachers: that computers in their schools were *only* for those learners doing the subject CAT. In fact the researcher observed that computer laboratories, in the sampled schools, were regarded as "no-go areas" for any learner save for the CAT students and their teachers. Having been asked whether she had used computers for learning before, learner C10A stated:

> *"Yes. I've used the computers here at school. We're using it here at the CAT Lab, Computer Application Technology. We're using computers to investigate." [Learner C10A]*

Learner C10A clearly explained that, because she was doing CAT, she could enjoy access to and use the computers in the school. Although learner C10B indicated that she had used a computer outside, she made it clear that not all learners had access to computers in the school.

> *"Yeah, I've used a computer as a learning tool, but am not using it here at school but I've used it before. I'm using it for Googling and stuff. I Google a lot of research, I think of the body of humans, so I use it a lot. I want to learn more with it. I think it's easier since I hate writing." [Learner C10B]*

Learner C10B said that she was keen to learn more with the computer as the computer enhances her learning given that she hated writing. In concurrence with her views, computers are seen in scholarly studies to enhance active learning, thus stimulating learners to explore further, eventually becoming constructors of their own knowledge (Mdlongwa, 2012; Edutopia, 2014).

The issue of computers being reserved for learners doing CAT at the expense of other learners was alluded to by all the participating teachers. Learner C11D raised it also:

> *"At school we were given an agricultural assignment, but as a tool we don't have computers, so I decided to go to a library to research the assignment. In order for me to go there I've to take a taxi. There are people, who are doing CAT, but me, I am not doing CAT, and doing Agriculture, so computers in the school are only for CAT." [Learner C11D]*

Learner C10C sadly concurred:

> *"'Mina' (myself); I've never used a computer. The only thing I use is a cell phone, because it's much easier to use since you know, you never get … what is it called … I am not a Computer Application student so I only use my cell phone to research you maybe. We've got an assignment and things like that; yeah." [Learner C10C]*

Learner B10D presumably had a double advantage as he indicated that he had access to school computers as a CAT learner, and made use of the nearby Municipal Library's networked computers to do research on his assignments. He stated:

> *"I used the computer in the library to search for knowledge for assignments and projects, and also use it in school as a CAT subject, learning how to send emails and make websites…, we go to libraries to research about it because in school we don't have internet because we don't have UTP cables, which give us access to network in a CAT subject." [Learner B10D]*

Learner C11E highlighted a myriad of ways through which he used computers in a number of computer centres to do research.

> *"I usually use the computer when am given assignments by the teachers; I usually go to the library or internet café to research and write it in point form or paragraph and also take the pictures to show verification of that. In particular, last year we were doing a Life Sciences project, which talks about the trees and all the stuff like that; it was about the trees, about the Biomes, so I'd go to the library to search for the information about the Savannah biomes*

and take the pictures. Sometimes I draw the pictures if I can't find them." [Learner C11E]

The general view of the learners was that they used computers *only* when they had been given assignments that they usually could not accomplish with the use of available textbooks. Because the computers in their schools were solely meant for studying the CAT subjects, they were compelled to visit the nearby municipal libraries to access community computers with Internet facilities, so that they could do other assignments and projects mainly for the "harder" subjects like maths and science. This revelation implies that the DBE should, as matter of urgency, revisit its computer policies at school level to enhance equitable and equal use of computer tools in secondary schools.

4.3.2 Frequency of computer usage by learners

The frequency of use of computers was found to be mainly dependent on the following factors: availability of and access to computers in the schools; distance from home to the local municipal libraries with computers that offer internet connectivity; affordability in terms of buying of school and personal computers and data bundles; whether a learner was a CAT learner or not; family background; and computer literacy. Lack of learners' computer *competence* coupled with malfunctioning computer, equipment, was assumed to encumber effective use of computers for the purpose of learning (Alkatani, 2017).As was note in Chapter 2, teachers' incompetence can contribute to learners' (Saxena, 2017).

Concerning the rate at which computers are used, many learners, from both Grade 10 and 11, indicated that they had accessed and used the computer facilities such as internet, but *subtly* highlighted that they used emails and CD ROMs for the purpose of learning. In accordance with the foregoing phenomena, learners were quote expressing varied frequency of computer usage in their learning process.

In congruence with other learners, learner C10Csaidthat she only used internet and not emails because she found it difficult to understand how email works, which translated into the fact that levels of computer illiteracy were still overwhelmingly high.

She mentioned that she *only* used the internet when given assignments, two or three times per month, which meant she *rarely* used it even when she used her cell phone.

> *"'Mina' (myself) I only use internet; I don't have an email address so find it very hard; I find it very difficult to have an email address. What is an email address? It's very complicated, G 'bani, bani' (G what, what). So I use internet maybe, for example, if 'kuphysical' (in physical) sciences this, uuh, what do I call this? Investigation; yeah, on colour changes, you know; in this school here we don't have much apparatus, you know, things to investigate, practical things. So I just login to see for myself; it's much easier. Ooh, I use it ONLY when I've something, you know a project, assignment and practical things. You know, things like that; yeah; about twice a term. I don't know the times exactly because I could get an assignment now, you know. I can get an assignment next month you know; yeah." [Learner C10C]*

When probed further, whether she had access to the computers in the school, learner C10C sadly revealed that she neither had a computer at home nor had access to the *two* computers in her school, so she relied on her cell phone to access the internet.

> *"No; we don't. The only people who have are the CAT students."[Learner C10C]*

In concurring with learner C10C, learner C10D revealed:

> *"I use the internet occasionally, yeah, because I hear new things every day that make me want to do research about those things and give the urge to research. I just use it and am getting to know about how the World operates in terms of technology". [Learner C10B]*

Learners from Grade 10 in school B indicated virtually similar or varied and irregular frequency of computer use compared to those indicated in school C. Learner background and lack of computers in their schools came out in what learners expressed.

> *"I use it approximately five times per week to Google things that I find very hard to do like finding formulas for physical sciences that we sometimes do not get from teachers. In books we just get formulas but from the internet, Google, we find formulas on how to calculate wavelengths". [Learner B10E]*

Learner B10D indicated that, as a CAT learner, he frequently used computers. Having no internet connectivity in the school he was compelled to always visit the municipal libraries with the required technological facilities. Learner B10DD reported similarly:

> *"I think I use it more than 10 times a month because we get assignments and we go to libraries to search about them because in school we don't have internet because we don't have UTP cables, which give us access to the network in the CAT subject". [Learner B10D]*

Concerning the frequency of use of computer tools like internet by these learners, learner C10B commented:

> *"I use internet a lot of times, half of my day using internet. And email – I do email; it helps me a lot. I didn't know how it operated until I wanted to know because now I had to move from my high school to this school, so I report on stuff being transported; so I use the email you see; to transport, take a removal letter and stuff.; so I used email. I learnt that 'ukuthi' (that) it's too easy; it's too easy; I thought it's hard; it makes it easy to see my parentsnow. They have to see the report– I can just email. The newsletters when they're from school we used to use them. In my school (meaning her old school) the newsletters used to be sent from the computer telling them about their children's behaviour and stuff and stuff; or I learnt that technology is really making our life easier. So I do Google almost all the time. When you tell a new word I go and Google it. I always do study how humans grow. So internet is good. [Learner C10B]*

Learner C10B reflected that there are glaringly varied family backgrounds, which give learners an unequal platform for accessing and using computers, hence that varies the frequency of using computers as a tool for learning. Learners from well-to-do families used computers much more frequently than the rest whose parents were poor.

Learner B10C used computers frequently, like learner C10B above. When asked of the rate at which she used computers learner B10C explained:

> *"Yeah; I use it like nearly on a daily basis because every day I learn new things, because I've got a lot of access so I do it music production at home because*

I have my own computer and home WiFi so to go onto Google I use that WiFi and search for information. Besides I use it in all subjects to get a better understanding of the learnt things." [Learner B10C]

From the findings above the frequency of computer use solely depended on the level of access to computers, at school, in municipal libraries, and/or at learners' homes. At home, frequency of computer access depended upon the learners' family backgrounds. Owing to the perception that there is a gap between learners and teachers on how best to use computers, learners thought that computers could be used both at school and outside the classroom (Llomack, 2008). That presumably allowed learners to continue with some practical homework after school. Eristi, Kurt and Dindar (2012) observe that learning that is supported with some practical activities, addressing more than one sensory organ, attracts learners' attention and interest, leading to permanent and meaningful learning.

However, in view of what learners expressed, coupled with supporting highlights from literature reviewed, the researcher perceived that most learners' backgrounds compelled them to use computers infrequently because their parents could not afford to buy them such learning tools. Learners' low computer literacy also compromised their rate of usage in the sampled schools. Findings also reveal that the rate at which computer tools, such as the internet, were used depended upon the number of assignments given to the learners by their teachers.

Exacerbating (the researcher felt) the effects of the teachers' less than frequent use of computer tools by virtue of their having little computer competence themselves, teachers failed to direct learners to relevant websites from which they could possibly retrieve information for their assignments. In a snapshot survey on ICT integration in South African schools, as was reviewed in Chapter Two, Padayachee (2017) found that computer technology was superficially and infrequently used. He writes:

> "The uptake of technology remains low; on average the frequency of usage per tool type was as follows: contextual tools (41%), sharing information and ideas as tool (29%), experiential tools (26%) and reflective dialogue tools (18%)" (Padayachee, 2017:36).

The researcher interprets the irregular and biased use of computer tools as a direct consequence of the mystery instilled in learners that computer usage can make

"harder" subjects like maths and sciences doable. Coincidentally, that judgement was presumably a blunt assumption of the DBE's that maths and sciences' pass rates could improve through computer usage (Ndlovu& Lawrence, 2012).

4.3.3 Computer usage: an enhancement towards learning

It has become a commonplace belief that proper usage of computer tools enhances meaningful learner performance and authentic ultimate academic achievement (Edutopia, 2014). To measure this belief, the researcher explored learners' views as to whether they perceived computer tools as having the potential to enhance authentic learning.

One of the learners from Grade 10, in school C, concurred that a computer was an essential learning tool that enhanced understanding, especially in physical sciences, unlike when learning using black and white paper pictures. In concurrence with the learner's perception of the phenomenon under study, Ndlovu and Lawrence (2012) asserted that the DBE assumed that supply and use of computer tools in disadvantaged secondary schools could serve as a remedy to ameliorate the dismal failure rate in maths and sciences. The learners said that computers showed more meaningful *pictures* that came in colour form:

> *"Well, I take it as a very important tool to my learning; you see…we don't see new things like now we're learning the heart. You don't see real parts of the heart because it's black and white, the papers and the stuff; so the computer is a good tool to make you see those things; you see. You may see the heart, the muscles. 'Ok these are the muscles. Are standing like this.' You see it's a very important tool that physical sciences, there're some Apps that you can download to learn like Mindset and stuff; they teach you more; they teach you most of it. It's definitely are fat the way I study if I don't want to lose more it's like most of the time am I focusing on the teacher. Sometimes I miss then I can catch up at home in those Apps and stuff." [Learner C10B]*

Learner C10C added that computer tools are not only making learning of difficult subjects like physics *easier*, but also made her understanding of mathematics much

easier. The researcher, taking cognisance of the quagmire of lack of learner support material that comes in colour form and animations, strongly concurred that computers could make a difference for learners to learn better.

In concurrence with learner C10B, learner C10C said:

> *"And in Mathematics." She added:*
>
> *"You know, when you see a picture and it's in black and white, and you're like, what is this? A muscle or what? But then on the…you can say OK I can see a muscle; OK I could see a brown colour OK. Yeah, I do agree with you; it's much easier to use the internet, and as you said, when you like looking at the teacher, sometimes you just like 'OK, what's she talking about?' And then when get home, you start logging in your internet and you're OK, because you can see the colour, you can see everything; you can see the movement and everything; so technology and computers and stuff are very important and cool." [Learner C10C]*

The researcher deduced that learners coincided in their views that computers enhance better understanding of difficult subjects like Life Sciences, Physics, Agriculture, etc. Use of *pictures* and *simulations* seemed to promote authentic learning.

> *"I actually use it when I'm doing Agriculture because Agricultural Science has got a lot of pictures that are supposed to be viewed by learners. I benefit, so in that way I know that when a teacher comes to class and teaches about something, when I research that thing I have a picture in my mind that's what the teacher was talking about. Then in Physical Science I only go and look for the laws, like previous papers – they do help when I'm practising for my exams and the practicals. Sometimes there're videos in the Internet of practicals; they help me to 'master' everything that sometimes I need to know because sometimes we normally don't do practicals because we don't have all the resources that we need." [Learner C11B]*

The researcher found that learners said that they could learn better using computer simulation programmes. Zupanec et al. (2013), when expanding on the importance of CAL, explained that because the CAL approach combines simulations and

visualisations it helps abstract concepts to be perceived in a more realistic perspective, thus encouraging better understanding of them.

> *"Well, it is important because it allows things that are in 'motion', like learning about the heart in Life Sciences, it is stable, it is not moving; so it's not really easier to learn it as it pumps. The heart, you know, it pumps; you can see it pumping; so I can say that it has improved my knowledge." [Learner B10C]*

Learner C11C shared the views of the above respondent learners. She added that the advantages of computer usage, alluded to earlier on, could be doubled because computer tools come with some videos that showed procedural steps that could be taken doing some Physics and Chemistry experiments, given the challenge of lack of apparatus in their schools.

> *"The internet and things you get from there, they're very important, you see; because some of the things, like learner B said, we don't do some of the Physics things and Chemistry part; so you can go there and see some videos and see how it's done; and maybe you can try and do it yourself, see if you can do it on your own." [Learner C11C]*

In regard to the importance of videos and computers simulations, achieved through use of CAL, Zupanec et al. (2013), as quoted by the researcher in Chapter Two of this study, posited that rote learning is minimised as the CAL approach combines simulations and visualisations. In corroboration with the foregoing learner C11C, learner C10 E commented:

> *"Computer, I see it as an important tool for me to learn; sometimes when there are experiments like Physics, Life Sciences, Maths, ooh not Maths; Physics, Life Sciences, Agriculture, I just go to the internet. If I haven't done it at school, I go to the internet and watch the video; sometimes the videos, for example the heart, when they're showing us the heart on the internet they show you the real heart, the cow heart, and cut it, and show you all the parts of it. You see the veins; it's really helpful, because you see all the things that are needed; and when I go to school I've got that idea of what I would be learning." [Learner C11E]*

Learner C11B expressed similar views. Above all he substantiated why he thought the internet was vital to authenticate their learning processes. Indicating that the internet *surpassed* the teachers that taught them, he strongly observed:

> *"Rather than seeing the teacher cutting the paper and acting as if, and drawing things at the board; and saying this is the heart, you actually know the true heart, how it looks on the internet. Yeah; internet is the number 1 teacher. Yes." [Learner C11B]*

As has been written earlier on by the researcher, critiquing some reviewed literature, "no matter how state-of-the-art computer technology may be, it remains a fact that a computer is as good as the teacher who uses it for teaching and learning". A teacher who does not have sound content and pedagogical knowledge inevitably fails to gainfully use an excellent computer tool for authentic teaching and learning. Therefore, the internet, unequivocally, will never surpass the work of the teacher; it is ONLY 'good' when the teacher knows exactly how to guide his/her learners on how and when to use it.

Learner C10A concurred in a way with the perceptions of learner C11B when she said that sometimes teachers used *bombastic* words that confused learners:

> *"And sometimes when the teacher is explaining things she uses words that are not even written down in the book. When you look at your script and then you hear the teacher explain, you just get out of control; they use 'big' words." [Learner C10A]*

Following upon confusing terms used by some teachers, learner C10B elucidated:

> *"We write them down and when you get back home and Google it you can now say OK this word just means an easy thing. It can also give another word which means the same thing. Yeah; and the internet can also break that word down so that you can pronounce it like 'ooh-aaah-ooh-aah', like we are teenagers, it's cool; and teachers like to use those bombastic words, like she couldn't just say it was fun, 'enthusiasticism' and stuff." [Learner C10B]*

All the participants concurred regarding the importance of computers, as computer tools allowed them to accomplish their given tasks much *faster* and more *easily*, especially in such subjects mystified as difficult. In other words, they implied that

computer usages *demystified* subjects regarded, historically, as difficult. In addition, participants agreed that the use of computer tools *motivated* them to *explore* more about the problems they would be trying to solve. Llomak (2008:3) comments: "In general, students are capable and motivated users of new technology." Accordingly, learner C11A asserted:

> *"Yeah, computers are important for learning because they're fast and they accomplish assignments easily, for instance Life Science. So when we are actually learning, say, about the structure of the kidney, you go to the internet, search for structure of the kidney then I can see it clearly with colours. They do some 'effects' in your life, you see; you say, oooh, wow! I'm impressed and interested; you want to know more, how it happens. So because we're tired of seeing BLACK & WHITE, so the heart is BLACK! You can't see what the teacher is saying." [Learner C11A]*

The researcher found that, beside what other learners alluded to as the importance of computers, use of computers was also perceived as having the potential to reach out to all learners with different learning abilities, styles and paces, depending on their IQs.

> *"From my point of view, I can say that computers are important because as we're all learners we've many different learning styles, so in my view computers are good because at school, not all the teachers can teach PROPERLY; some just make us SLEEP; so I can say that computers are not even BORING; they can even make you understand properly and [keep a] high level of excitement energy." [Learner C11D]*

Lastly, participants highlighted that the use of computers enhanced equitable learning as they promoted *sharing* of the researched information with peers who could not have access to the internet connectivity facilities. Deaney, Ruthven and Hennessy (2003),as cited in the literature reviewed, mentioned that the use of the internet promotes easier and collaborative seeking and abstraction of information, with learners being professional guided by their teachers, thus achieving authentic teaching and learning across the curricula. In agreeing, one of the participating learners asserted:

"As peers we do not really know same things; so I can come and share with them everything that I know; like on Google, I've access to the internet; not all of them have access to it, so I can come and share with them so that everybody can be happy. Sometimes I print the information, and then I share it with my peers. So I get information from Google about Life Sciences: we've to learn about the heart and the like; and then with music I can make a bit then send it to someone else who's got email; so I share information with others who don't know about it. I also use the photo shoot App to design the cover. Let's say we've got an assignment or project in the school for them, we share." [Learner B10C]

Computers promote learner collaboration, thus enhancing meaningful learning through sharing in the sampled secondary schools.

"*OK. My Google account does show this: when I ask the question many people do answer this question because we're people and we've different ideas, so I find many ideas on the internet, because when I ask the question, not just one person will answer that question; many people do answer it and I, from there, I learn different ideas about how to answer the question, and you know … you know it's like that." [Learner C11B]*

Irrespective of whatever importance computers afford learners, like learning faster and with better understanding, the literature reviewed revealed some learners' contrasting perspectives as they expressed concerns that creep into their learning environments, perpetrated by the advent of computer tools in the teaching and learning process. Tartarashvilli (2017) was quoted in Chapter Two of this research positing that learners were concerned about loss of interaction between their teachers and themselves, resulting in a disturbing alteration of classroom "norms". Learners indicated that such a scenario ultimately results in learners failing to get appropriate societal education in terms of values and standards expected of them in their surrounding communities. The researcher agrees with the foregoing author because computers have no human feelings, and above all they are programmed machines, hence not as flexible as a human being.

Nevertheless, findings revealed that learners concurred that computers play a crucial role in enhancing meaningful and authentic performance and ultimate authentic

achievement. In subjects considered to be difficult, such as Physics, Maths and Life Science, learners expressed a similar view that the use of computers as a tool made the learning of those subjects much easier and faster. In concurrence with the rest of the learners, learner C10B complained that sometimes teachers used complicated, 'bombastic' words that ended up confusing them.

> *"Bombastic word…very complicated word you can't even understand; it's actually hard to pronounce. Even in Life Sciences you can even bite your tongue…we write them (bombastic words) down and when you get back home and Google them, you can now say OK this word just means an easy thing. It can also give another word which means the same thing." [Learner C10B]*

Learners concurred that viewing the coloured pictures, videos and simulations on the computer stimulated them to want to explore more about the respective topics, thus enhancing the authenticity of their learning. Learners said that in English Language classes, some of their teachers used "complicated" words, which only proved easier when checked for their meanings, making use of computers later at their homes or in municipal libraries. In this regard, Siemens (2005), one of the co-founders of the theory of connectivism, was quoted by the researcher in Chapter Two asserting that learning could be referred to as a complex art of connecting, nurturing connections and information sources, ultimately enhancing that learning becomes more critical than knowing. The researcher, therefore, strongly considers that when learners are looking for further clarification on the internet they are using computer tools that promote critical and independent thinking and learning in students.

4.3.4 Learner challenges, stakeholder support provided, and suggestions

4.3.4.1 Learner challenges

With regard to challenges inhibiting learners from benefiting from computer usage in their learning process (Alkatani, 2017; Saxena, 2017), learners highlighted a number of problems as follows: teachers' lack of computer training to meaningfully guide learners on where, when and how to use computer tools in their learning; teachers' negative attitudes, and fearing that integration of computers in teaching and learning threatened their job security; inadequate computer resources, etc. Consequently, in

their quest to use computers as a tool for authentic learning, learners mentioned similar challenges that inhibited them: *shortages of computers; parents &/or guardians' misconstrued perceptions; theft; family financial backgrounds; time wastage in queuing for internet usage;* and *high cost of transport and data*.

Parents were sometimes seen to hamper their children's use of computers because they thought that the advent of computer tools *derailed* their children from expected cultural values and standards. Furthermore, parents thought that their children would be *distracted* from doing the "real expected" schoolwork, so they tried as much as possible to discourage their computer usage.

> *"Well, most of the time older people see computers as things that will destroy us; they don't see the positiveness in computers. Older people always see computers negatively: 'they'll do this to you; they make you lose focus on your cultures and things like that.' They don't really understand. Yeah, parents, guardians, older people, who don't really understand computers, are like that. Sometimes you just decide to speak English at home, and they say 'Woooo'! This girl is so spoilt, these computer things!" [Learner C10B]*

However, in contrast with learner C10B, learner C10C seemed to concur with older people's perceptions regarding the use of computers when she commented:

> *"But for me, I am addicted; I don't want to lie; it's too addictive for me. It's like you go to it like you'll never do anything for the rest of the day; you'll be just sitting next to it (the computer) because you want to do more and more. Sometimes you do gaming and you want to leave; you'll always say: 'Now I want to get to this score, I want to get to this score'; yeah, to leave the gaming! But the Googling is so funny; I don't know why (older) people are so fussy." [Learner C10C]*

Learner C10C alluded to the point of getting addicted in persistently wanting to be on the internet at the expense of dedicating her time to studying other subjects. What she expressed is a clear manifestation of lack of parental and teacher guidance an advice, which results in streamlined learning being compromised. Thus Lee, Waxman, Wu, Michko and Lin (2013) indicate that the benefits of the internet and emails squarely depend on how teachers guide and supervise learners, otherwise

uninformed “supervision” of learners will cascade into learners getting distracted from surfing relevant educational websites.

Learner C10A felt that besides being addicted being perceived as a challenge, parents evoked a worse cascading challenge by taking the computer away from their children, thinking that they were ameliorating the damaging effects of computer use:

> *“Sometimes if you are addicted parents can take the computer away from you, so you will feel your ‘world’ has been just taken away from you.”*

Following up, learner C10C affirmed:

> *“They don’t know that it’s your whole ‘world’; now they’re taking it away from you; where am I supposed to live?” [Learner C10C]*

So basically the challenge here is that besides getting addicted, learners felt frustrated because their parents/guardians do not view current technology in a similar way. The millennial generation become frustrated if denied the opportunity to use computers, even if they were into gaming, or just chatting with friends, etc.

One participating learner said the scarcity of computers compelled their teachers to make them learn more theoretical work than was necessary, so learners got bored. Learner C10D frankly admitted that continually doing theory was boring, and she hated writing all the time. Presumably she was implying that it was easier learning with a computer than writing.

> *“We’re not able to do everything we want to do because of the computer shortage. At the beginning of the term we were only dealing with theory, and that was very exhausting because we really wanted to do practicals. We really wanted to see what the theory was talking about … there’s a computer, there’s the desktop. And we really wanted to see that. We wanted to see it. That is a challenge.” [Learner C10D]*

Learners attributed the shortage of computer resources in their schools to the rampant theft that was alluded to by teachers in the same secondary schools. As this chapter has detailed, a large number of computers were stolen.

> *“The lab was vandalised last year, so they stole laptops…I don’t know; so many”. [Learner C10A]*

Poor family backgrounds hindered regular use of computers by learners. This was revealed by learner C11B when he indicated:

> *"As learners we come from different homes; so some homes can't afford to buy computers for their children; so some children don't get to touch computers. Then sometimes they don't have money to buy data to get to the internet, so without data you can't get access to the internet. The problem that we are having is that we don't have computers in the school. Children who have access to them are those that are doing Computer Applications Technology. So they don't own them; they're teachers' computers; they borrow them from the teachers, then they do what they want to do with the teachers' laptops, then they bring them back. It's like that. You cannot save anything that is your own in somebody's laptop."[Learner C11B]*

Specifically alluding to the lack of access to the school computers as a challenge, learner C11C mentioned the waste of time waiting in a queue for a chance to use a computer in the community library.

> *"Yeah, starting from school, am not even sure we've permission to go to the computer lab. I think it's only CAT learners who've permission to get in there. The library is so far from where I live. In the library you've to wait for a couple of hours before you even get the computer. When you book for a computer the time is limited, like for 30 minutes; so you can't really do what you want to do because in 30 minutes there's nothing you can do." [Learner C11C]*

Learner B10B agreed:

> *"OK, if I want to research about something, I must go to the library. When you go to the library you find that there're many people, you don't have access to the computer because there're many people, so you have to wait for those people to finish, and if the time goes on you have missed researching the subject, always because there're many people. So we end up not doing our project or assignments. So that's the challenge we face at school." [Learner B10B]*

Learner B11A basically had similar sentiments:

"I think we have a problem in some families. Our families can't afford to buy us computers or laptops, so we've to go to libraries and at libraries it's like there're more people waiting wanting to use the computers so we don't have the time to use computers most of the time in the libraries." [Learner B11A]

Learner B10Dalso said that visiting the library to make use of the computer incurred high transport costs owing to the distance.

4.3.4.2 Stakeholder support provided and suggestions

From what learners highlighted, it appeared that they were not very sure of the support afforded to them by the stakeholders.

"We're getting support from teachers because they pass our issues to the DBE; they (teachers) say they'll try to save money to buy more computers because we don't have enough computers to use." [Learner B10A]

Meaningful support was evident from parents as they bought their learners computer resources. One of the participating learners referred to computers, WiFi router and music accessories bought for him:

"I get support from my parents who're the ones who bought the whole thing for me, and I got support from my teachers. They're the ones who taught me the basics of the computers at school. I actually [learn] from my peers, who teach me from here and there some things that I don't know." [Learner B10A]

Findings reveal that besides being taught computer literacy, this participant highlighted that he received some guidance from his teachers on how to get relevant information for use in completing his assignments. He also alluded to the support he received from the computer tutorials on how he could improve his computer literacy.

The researcher clearly observed that there was no tangible support Grade 10 learners could speak freely and confidently about from the SGB, the DBE, donors, teachers and peers apart from that mentioned above.

In relation to the kind of support learner B10A experienced, he asserted:

"I think we don't get enough support from the SGB because some computers at the lab (CAT Lab) are not working. Maybe 13 (working computers) so we've

to share; so that is a problem when a teacher gives a practical you've to do, you've to share a computer with someone or have to wait for the person to finish then you have to use the computer." [Learner B10A]

In the light of the challenges discussed above, learners concurred on a number of suggestions. LearnerC10C suggested:

"The government should supply more computers for learners because the computers here are only for CAT learners; so I suggest that the government supply us with computers programmed with software for learning; it should be for all subjects."[LearnerC10C]

A learner who did CAT as a subject said:

"I suggest that every community must have a library so that community members can have access to computers, and also learners so that they can learn easier. It'll be easier to go to the library." [Learner B10D]

One of the participating learners felt that the problem of theft lay with them as the learners divulged inside information that the school had received so many computers.

"Well, we know that they (learners) do it anyway, so I suggest that in future the security level should be increased at school so that they'll not just come in and steal the computers." [Learner C11C]

Learner C10C also said:

"Sometimes the leaders are the learners (in stealing of the computers).They tell those people who steal computers that we now have computers, there're so many and maybe they say they're cleaning the lab at this time; they give them so much information."[Learner C10C]

Learner C10C indicated that they received no meaningful support from teachers due to the teachers' own incompetence.

"They always tell us to download previous exam papers. You know they're always telling us what to do, you know. But they're just telling us, doing nothing." [Learner C10C]

4.4 CLASSROOM OBSERVATIONS

Participant observation was done with the aid of a classroom observation schedule, which was analysed to compare and contrast both teachers and learners' findings that were revealed during the semi-structured teacher interviews and learner semi-structured focus group interviews. The thematic approach was systematically employed to come up with salient themes on how teachers and learners interacted during lessons, specifically in using computer tools in the teaching and learning. From the classroom observation schedules, the researcher came up with the following themes to be analysed and interpreted accordingly:

4.4.1 Computer accessibility

4.4.2 Appropriateness of computer usage

4.4.3 Enhancement of higher order thinking skills;

4.4.4 Monitoring and supervision of learner computer usage;

4.4.5 Preparation for effective computer usage lessons.

4.4.1 Computer accessibility

In terms of accessibility during lessons, findings revealed that computers were extremely inadequate for the number of learners using the computer tools. Generally, teachers were using one computer to project the content learnt for a class of 45 learners. Therefore, learner-computer ratio was basically zero apart from CAT lessons, where the ratio was one to two, i.e., two learners sharing one computer. Such scarcity of computers was due to the rampant theft alluded to by both learners and teachers, as discussed in the previous sections.

4.4.2 Appropriateness of computer usage

The use of the computers, given their phenomenal scarcity, was reduced to mere drill and practice. Basically the use of computers in these overcrowded classes should

ensure that all learners can be accessed by the teachers at the same time. However, the situation could not allow learners to be more active as they were restricted to merely watching and discussing what their teachers were projecting, and not using computers themselves.

4.4.3 Enhancement of higher order thinking skills

The researcher established that the teachers were merely changing slides and giving corresponding explanations, and nothing more. Of the total of six lessons observed, two of them were CAT and maths lessons, where the researcher at least found learners interacting with the computers, which presumably promoted development of their higher order thinking skills.

In one of the CAT lessons, which was observed in secondary school C, Grade 11 learners were practising how to develop web-pages using Hyper Text Mark-up Language (HTML) programming language. The researcher observed that the learners were hands-on – actively engaging with the computer and collaborating in pairs. HTML allowed them the opportunity to see whether they were doing the right thing or not, because if they issued a wrong instruction they could not get the intended outcome. The learners proved to be highly motivated as they enjoyed real-time responses and feedback. Controlling and guiding the learners' activity, the teacher moved around the computer lab, checking their progress.

Findings also revealed that learners were actively engaged during Grade 10 lessons in school B, where they were using computer tablets. Learners could just login using their usernames, and go straight into that day's lesson that was pre-programmed by Siyafunda Donors. In addition, learners could assess themselves because each time they failed to do the correct calculations the computer would indicate where the learner was getting it wrong. The teacher, besides moving around the class checking and assisting learners, could also check their progress through the donated Server computer.

4.4.4 Monitoring and supervision of learner computer usage

In the CAT and Siyafunda maths lessons the researcher established that teachers were monitoring the learning process in a more meaningful way. They could move around assisting the struggling learners and give assistance there and then. In terms of the learners collaborating through the computers themselves, they could not as they were networked in such a way that they could only collaborate with their teacher. However, monitoring of learners where lessons were projected on the board was virtually non-existent.

4.4.5 Preparation for effective computer-usage lessons

The PowerPoint presentations observed, during classroom observations, revealed that teachers prepared for their lessons. The slides projected for the learners included comprehensive notes, explanations, questions and expected possible answers.
With regard to the Siyafunda maths lessons, they were pre-programmed for the teachers; the researcher felt that they were effective, and were to be considered excellent if it was done across the curricula. Maths teacher AA explained:

> *"There's a project called Siyafunda… And what it does is there's a programme that's loaded on the tablet; learners login to the tablets and they can go and do some activities, which are loaded on the programme. So it's a very interactive programme, and it gives real time responses on how they're doing in terms of activities." [Teacher AA]*

The maths teachers virtually served as coaches or facilitators of the learning situations. Towards the end of the session, the learners are given mathematical problems to attempt on their own at home. Unfortunately, as was revealed in the analysis of the semi-structured interviews, hardly any of the learners had a computer at home. Therefore a teacher could not give learners homework that required the use of a computer, given that most parents could not afford to buy a computer for their children.

4.5 CHAPTER SUMMARY

This chapter presented a systematic analysis of the findings obtained through the use of semi-structured teacher interviews, semi-structured learner focus group interviews, and classroom observation. Six teachers and 30 learners were interviewed to elicit the participants' views.To substantiate data sought through interviews, six lessons were observed to cross-validate and triangulate the findings.

The research objectives intended to establish perceptions of both teachers and learners on the use of computers as a tool in teaching and learning, and the kind of classroom support and guidance that was available to learners to facilitate teaching and learning in the secondary schools in Pinetown District.

Although, through semi-structured interviews, teachers and learners unequivocally acknowledged that computers play a vital role in teaching and learning, classroom observations proved otherwise. Since computers were so scarce, and teachers' competence in using them inadequate, classroom observations showed that the only computer available was used to project slide-lessons on the board. "The teachers in these schools are still in the phase of using ICTs to merely transmit subject content rather than utilise the technologies to enhance learning" (Ndlovu & Lawrence, 2012:12). Nonetheless, attending to over 50 learners per class, using a data projector can mitigate the problem of overcrowded classrooms in these schools.

In view of the above, the researcher concludes that, save for CAT and maths lessons, where the computer-learner ratio was generally one to two, the lessons observed in other subjects, like history and English, proved to be merely teacher-centred, hence authentic learner-construction of their own knowledge was found to be conspicuously lacking.

In spite of the grave deficiencies noted above, the findings reveal that most participating teachers and learners concurred that computers play a pivotal role in enhancing authentic teaching and learning in secondary schools. However, the overall findings of this research are strongly in support of the research evidence (Ndlovu& Lawrence, 2012; Bhalla, 2013; Vandeyar, 2015; Padayachee, 2017) that

the use of computers as a tool for effective classroom instruction and learning in secondary schools is insignificant.

The participants further concurred that the challenges encountered in their schools made using computers very difficult, especially the rampant computer theft. The overall suggestion of the findings was to build very secure computer rooms. The researcher also found that both teachers' and learners' lack of proficiency with computers resulting in irregular and superficial use of them.

Last but not least, lack of vision on the part of the SMTs was viewed as an unfortunate culprit in the general educational malaise affecting computer use, which presumably emanates from their lack of understanding of the management's e-Education and e-Learning policies. The SMTs' 'lack' of understanding was found to be due to the fact that these policies were just 'imposed' on them without sufficient advice on how exactly they could be implemented (Vandeyar, 2015).

The following chapter presents a summary of the study, and detailed concluding remarks based on the information presented, followed by recommendations on what could be done in the light of the study findings and conclusions for improvements in implementing e-Education policies in secondary schools. The chapter concludes with suggestions on investigating areas and topics not covered in this study

CHAPTER 5

SUMMARY OF THE RESEARCH FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The previous chapter focused on data presentation, analysis and interpretation. This chapter concentrates on the summary of the key findings of the entire study, the conclusion and recommendations on the use of computers as a tool for teaching and learning in three secondary schools in Pinetown District in KwaZulu-Natal. The principal aim of this study was to explore both teachers' and learners' perspectives on computer usage for teaching and learning in secondary schools.

The study adopted a qualitative paradigm in carrying out this research. Specifically, through triangulation of teachers' semi-structured interviews, semi-structured focus group interviews for learners and participant observations, the study revealed a number of findings, especially, challenges hindering both teachers and learners from using computers to enhance meaningful teaching and learning across the curricula. Through purposive sampling, the study included a total of six teachers and 30 learners, who constituted the complement of the study sample from three secondary schools, as was specified in Chapter 3 (research methodology) of this research. This chapter, therefore, highlights summary of the key findings of the study, supported by relevant literature, and ends by providing suitable recommendations that could be adopted.

5.2 SUMMARY OF THE FINDINGS

This part of the chapter revolves around summary of the major findings that emerged in Chapter 4. The following salient themes are summarised with regard to teachers and learners' views on computer usage for teaching and learning in secondary schools:

The salient importance of computers for teaching and learning; common computer uses; nurturing learner computer usage; challenges, stakeholder support and suggestions; rampant theft of computers resources; learners' views about the use of computers as a tool for teaching and learning; learner challenges, stakeholder support and suggestions.

5.2.1 Themes with regard to teachers' views

Through systematic data analysis extracted from teachers' one-to-one semi-structured interviews, five subthemes emerged, namely: *teacher demography; importance of computers for teaching and learning; common computer uses; nurturing learner computer usage; and challenges, stakeholder support, and suggestions.*

With regard to teacher demography, quantitatively analysed, the study revealed that, irrespective of individual teachers' number of years of teaching experience, the generality of the participants were found to be using computer tools with almost similar frequency for the purpose of improving their teaching. However, the study revealed the surprising fact that teachers without formal qualifications favoured a similar, if not higher, degree of computer usage than the few holding formal computer qualifications. Consequently, the researcher inferred that the teachers' attitude, and keenness to learn more about the importance of using computers, as was revealed by Vandeyar (2013), determined the rate of computer usage for teaching and learning by the teachers.

With regard to importance of computers as a tool for teaching and learning, all the participating teachers concurred that computers play a vital role. Similarly, making reference to importance of authentic learning for the 21st century from teachers' perspectives, Lombardi (2007:2) writes, "Most educators consider learning-by-doing the most effective way to learn." Generally, teachers specified that computers were important because they aroused interest in learners; ameliorated discomfort caused by overcrowding of classes; improved learner-discipline (Edutopia, 2017; Gokcearslan, 2017) during the instruction and learning process; struggling learners

indicated marked improvement in test scores; and note writing was discovered to be effective and quickly done.

Teachers in the area studied also indicated that they used computers for preparation of lesson plans and worksheets, typing of mark sheets, projecting lesson slides and researched work on the board for the learners to take notes and hold discussions in virtually all the subjects. This showed that the potential of computers was reduced to very superficial usage when used only for CAL, CAI and CMI. These findings are similar to the ones alluded to by Ndlovu and Lawrence (2012), Bhalla (2013) and Padyachee (2017). In fact, the researcher perceived this level of computer usage as a reflection of teachers' merely advancing and supporting their traditional teaching styles, because it was noticeable in the interviews that learning was still teacher-centred.

Because of the serious scarcity of computers in these schools, poor learner family backgrounds and serious computer illiteracy levels, teachers indicated that they did not encourage learners to use computers except for the few who were specialising in CAT and maths. Teacher computer knowledge remained shallow because of the short one-week workshops some of them were afforded by the DBE and NGOs.

Almost all the participating teachers expressed serious concerns about consecutive wholesale theft of computers as the major and commonplace challenge that inhibited them from regularly using computers across the secondary school curricula. All three secondary schools reported that they had experienced theft of computers twice or thrice from the time the DBE and some donors supplied and donated computer resources. Corroborated by the pictures taken by the researcher, it was clear that prioritisation was a problem in the sampled schools. For example, one school received computers, and the management naively just stored them in a classroom without any security features like simple burglar guards in place.

In the light of the above revelations, a question that comes to mind is: *"How could the SMTs just pack such precious gadgets in classrooms without security of any kind, knowing very well that criminal activity is very common in these urban and rural wards?"* This carelessness on the part of the management could be due to lack of

vision, as some participating teachers called it during the interviews, which could be due to the fact that they were not aware of what to do, not to do, in terms of e-education policy intents (Vandeyar, 2015). The literature reviewed revealed that e-learning education officials perceive themselves as mere conduits of the national e-education policies (Vandeyar, 2015), so they fail to induct the implementers accordingly, the inevitable result of which is infrequent and irregular use of computers in the disadvantaged schools. In fact this behaviour could be indicative of a failure to understand how precious that equipment is for use in the teaching and learning in the 21st century. Writing about the "need for a pedagogical shift" in Cyprus high schools, Charalambos and Mcisaac (2010:129) state, "For successful technology integration in schools, teacher education programmes play a crucial role."

The irregular and superficial degree of computer usage in the secondary schools studied was alluded to by Smith and Hardman (2014) when they discussed the Khanya maths project in the Western Cape. These authors seemed to assert that CAI was used for drill and practice, which was in sharp contrast with authentic learning (Lombardi, 2007) for the 21st century, and, the researcher believes, in sharp contrast with the theoretical perspectives of connectivism (Siemens, 2005), which contends, as cited by the researcher in Chapter 2, that "knowledge is fast changing, exponentially, at such a speed that what may be considered correct knowledge and skill or procedure today could be obsolete in the near future", which the researcher could equate with the demands of the Fourth Industrial Revolution.

5.2.2 Themes with regard to learners' views

The following subthemes surfaced through the use of semi-structured focus group interviews of learners: *computer usage in the learning process; frequency of computer usage by learners; computer usage: an enhancement towards learning; and learner challenges, stakeholder support provided and suggestions.*

In concurrence with Llomak's (2008) view, the study found that all learners knew that computers were essential elements that could possibly support and facilitate authentic learning. Ngwu (2015) seemed to concur by stating that computer usage

could keep learners engaged on given problems and challenging tasks in their learning process. However, it was noted with dismay that almost all learner complements cried foul over a serious challenge of inaccessibility to the computer resources in their schools, citing challenges of scarcity caused by devastatingly total theft of computers, as was echoed by their teachers, in their respective schools.
The study also revealed that the few computers found in their schools were *only* meant for the learning of Computer Applications Technology, and that generally computers, especially those donated to the schools, were used exclusively by maths (Smith and Hardman, 2014) and science learners. This phenomenon could be interpreted as a biased use of computer resources, which could translate into another sub-challenge hindering computer usage across the curricula. This same problem of bias was also noted by Dambudzo (2014), whose emphasis was on the "lived experiences of learning Geography in Zimbabwean secondary schools using computer technologies."

Given the overwhelming shortage of computer resources in the secondary schools studied, and the very high computer illiteracy levels on the part of the learners, the study not surprisingly revealed that computers were irregularly, infrequently and superficially used by most learners. Some learners could not even use computer tools such as emails, as they misunderstood them as something abstract, beyond their reach. That created animosity in most learners as they felt discriminated against. As cited by the researcher, in Chapter 4, one of the teachers asserted: "*They've created this 'stereotype' with learners that if you are not doing maths and science you are not smart enough; and the learners who are doing maths and science are always given more opportunities than the others.'*

That was really an astonishing revelation by the participant teacher from one school, echoed by a learner from different school. The researcher actually found that use of computers across the curriculum was a sort of "taboo" in these secondary schools. Not that learners were deliberately denied access, but the computers were not available for all learners to use.

In terms of support learners revealed that they did not even remember any kind of stakeholder support except from some of their few well-to-do parents. In fact the study

revealed that learners did not even know whether the DBE had an obligation to provide computers in their schools as they rightly pointed out that they had not even seen a DBE official announcing a supply of computers to their schools.
Nearly all the learners were appealing to the DBE to supply them with computers so that they could learn computer literacy skills, as the outside world demanded that they have such skills to be competitive and gainfully employed.

5.2.3 Themes of classroom support and guidance

The following subthemes were obtained through six classroom observations, meaning one lesson was observed per each participant teacher: *computer accessibility; appropriateness of computer usage; enhancement of higher order thinking skills; monitoring and supervision of learner computer usage; preparation for effective computer usage lessons.*

The rationale for classroom observations was to compare and contrast what participant teachers and learners highlighted as their views during interviews. Therefore, the researcher strongly felt that triangulating the data sought through semi-structured interviews and participant observations could be useful in cross-validating the findings hence coming up with more meaningful conclusions and corresponding recommendations.

Lesson observations accentuated the fact that computers were superficially used as in almost every lesson observed the teacher was the only one touching and using the computer. All learners could do was simply watch and listen to what was being projected for them.

In terms of support, the situation during classroom observation indicated that there was no meaningful support as suggested by researchers like Eristi et al. (2012). The lessons observed indicated that most of the time, except for maths, science and CAT subjects, and teachers used their own computers to teach students. As cited by the researcher in Chapter 2, Ngwu (2015) suggested that “because teachers are more than willing to use computers in teaching and learning, constant on-going support

regarding computer use is obviously needed." Unfortunately, the lessons observed generally revealed that virtually no learner could actively use a computer as the learner-computer ratio were zero.

Through thematic analysis one of the major themes that surfaced was "enhancement of higher order thinking skills", which the study revealed could not possibly be achieved because computers were so scarce. The researcher found that the teacher could hardly monitor whether learners were benefiting or not as they could be stuck in front explaining to more than 50 learners per class. The researcher therefore concurs with Mathevula and Uziweyimana (2014) that shortage of computers prevents teachers from performing the way they would have wanted for learners to benefit meaningfully. To worsen the situation, Salehi and Salehi (2012) say that the time allocated for teachers to teach with computers was too short to enable them to teach their subject well.

5.3 CONCLUSION

The study revealed that triangulation of data collection methods promote eliciting of rich and in-depth information from research subjects. Having explored and interpreted the aforementioned themes coupled with revelations highlighted in this study, the researcher concluded that: (i) teachers and learners lacked the necessary computer competence to meaningfully use computer tools for authentic instruction and ultimate learner academic performance ; (ii) the number of computers available for use across the curricula was alarmingly low, if not zero, hence the insignificant and irregular computer usage in these secondary schools; (iii) wholesale theft of computer resources was found to be a commonplace challenge that constrained use of computers across the curricula; and (iv) last but not least, the lack of vision on the part of the SMTs was found to be so appalling that CAT subjects could be expunged, at any juncture, from the curricula if the DBE too sluggishly pays appropriate attention to the challenges faced by the teachers and learners in Pinetown District secondary schools.

5.4 RECOMMENDATIONS

Having critically analysed the myriad challenges bedevilling our secondary education system, as was revealed by the research subjects, such as: literacy levels; biased, irregular and superficial computer usage; blurred vision on the part of the SMTs concerning the role played by computer tools in the 21st century; theft of computer hardware and its accessories, etc., this part of the chapter attempts to make recommendations which, it is hoped, would ameliorate revealed constraints and ultimately help improve the use of computer tools in our secondary education system.

5.4.1: The DBE should make it a policy that computer *literacy* constitutes an indispensible aspect of teacher training. Computer integration modules should be made compulsory as an essential complementary part of the pedagogical, and/or didactics, curriculum for those who train as teachers in virtually all teachers' educational institutions, as the world is *irreversibly* evolving towards the Fourth Industrial Revolution, which demands highly technologically qualified human capital. Furthermore, student teachers should be critiqued, by their university lecturers, practising teaching with the aid of computer tools throughout their teaching practice programmes.

5.4.2: The overall arguments propounded in this research reflected that theft of computers constituted the commonplace problem that cascaded into scarcity of computers in the schools. In this regard, the researcher recommends that tight security *systems* be put in place before computer resources are supplied to the schools. The researcher recommends that the DBE put *surveillance camera systems* in all schools before supplying computers, as it appeared, from the study findings, that known members of the surrounding communities could be responsible for stealing these computers from the schools.

5.4.3: After supplying computers to the secondary schools, whose laboratories would be presumably well secured, the DBE should *evaluate* its computer projects in terms of compliance with its intended goals to ascertain the extent to which computer tools are used for authentic instruction and learner

academic achievement. The researcher strongly feels that for e-education policies to be meaningfully implemented, the DoE should *clinically supervise* the way computer tools are used in its secondary schools. In fact evaluations by the DBE should take computer projects' implementation and evaluation in its schools as an ongoing programme, with permanent accountable personnel that should provide it with monthly progress reports, so as to ascertain pitfalls preventing proper use of computer tools in the schools.

5.4.4: In terms of lack of *vision* on the part of the SMTs, the researcher strongly feels that *proper training and induction* of school managers should constitute the DBE priority concerning e-education policies, so that they would be aware of their job descriptions in terms of "Dos" and the "DON'Ts" when it comes to marshalling how effectively supplied computers should be effectively and efficiently used in preparing learners who will squarely fit and contribute in the development of their country at the advent of the Fourth Industrial Revolution's work requirements.

5.4.5: Last but not least, the researcher expects that the arguments propounded in this research *should not be taken* as a panacea for solving problems concerning superficial computer usage in secondary schools. Those who read them are encouraged to be cautious and accept that challenges sometimes vary from one school to another. It is necessary to tackle each computer usage challenge from a broad perspective and contextual manner to keep in step with technological changes so as to avoid archaic and rudimentary strategies in a bid to improve on effective use of computers tools for authentic teacher instruction and ultimate learner academic achievement.

5.4.6: Furthermore, in regard with the aforementioned findings, to promote efficient and effective computer usage in line with authentic teaching and learning in secondary schools, the researcher *proposes* an Industry 4.0 Teachers' Professional Repertoire model entitled: "*Technological Pedagogical Educational Psychology Content Domain* (TPEPCD) model". The researcher first *adopted* this model from Mishra and Koelher's (2006) *Technological Pedagogical Content Knowledge Model* (TPACK), which was a development

of Shulman´s (2004) *Pedagogic Content Knowledge* (PCK), and adapted it to suit this study, as explained below.

The rationale to adopt and make necessary adjustments to the TPACK model is embedded in Kennah's (2016:21) argument, that in order to foster effective teaching and learning in the 21st century, active involvement in computer technology incorporated courses were found as the primary strategy for teacher training institutions, so that teachers would presumably be well prepared to meet demands of Industry 4.0.

In line with Industry 4.0 human capital requirements, the researcher therefore developed TPACK into the TPEPCD model. The researcher decided to add an educational psychology (EP) domain, because a teacher who holds sound pedagogical, content and technological domains also requires meaningful knowledge concerning the cognitive, affective and psychomotor psychological perspectives in order to streamline his/her instructional strategies to take cognisance of levels of psychological development of each age cohort of learners.

In corroboration of the need to include an EP domain in the TPACK model, the researcher took account of Seifert and Sutton's (2009:11) argument about diversity in learners' different learning requirements when they asserted:

> Whether in the past or in the present day, students learn at unique paces, show unique personalities, and learn in their own ways. In recent decades, though, the forms and extent of diversity have increased. Now more than ever, teachers are likely to serve students from diverse… backgrounds, to serve more individuals with special educational needs, and to teach students either younger or older than in the past.

The researcher strongly feels that a 'good' teacher, besides holding sound TPACK domains, requires a strong training background pertaining to educational psychology in order to streamline his/her instruction activities diligently.

As quoted in Chapter 2, in concurrence with Siemens (2005), 'today's learning process involves connecting, nurturing connections and information sources', taking

cognisance of the nature of the recipients (learners psychological attributes).The proposed TPEPCD model, by the researcher therefore aligns itself with the theory of connectivism (Siemens, 2005) in which this study is grounded. The researcher strongly feels that an educational psychology domain should be part of Mishra and Koehler's (2006) TPACK model, as educational psychology is concerned with an understanding of the child, his development, his needs and his potentialities (Aggrawal, 1995; 2004), which could promote crafting of authentic learning situations, taking cognisance of group dynamics as it affects learning.

This proposed model for Industry 4.0 Teachers' Professional Repertoire entitled "Technological Pedagogical Educational Psychology Content Domain (TPEPCD) model" is illustrated in Figure 5.1 below.

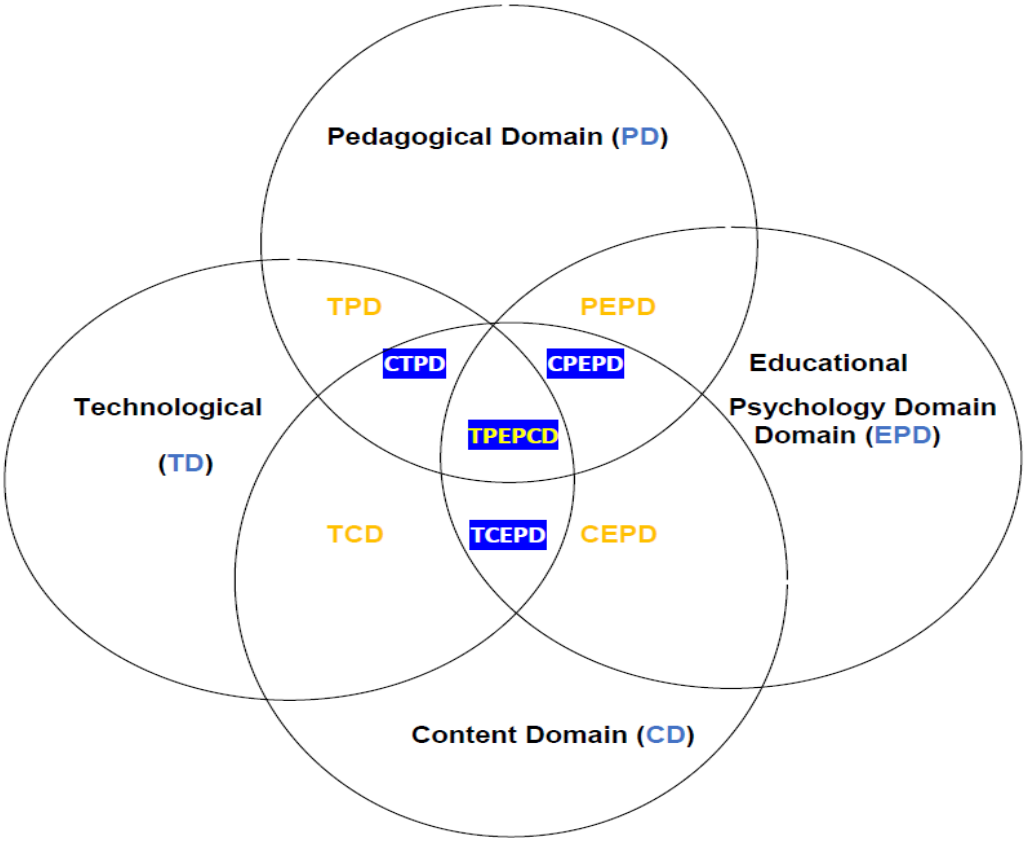


Figure 5.1: Technological Pedagogical Educational Psychology Content Domain model (TPEPCD)

KEY

TCD: - Technological Content Domain;

TPD: - Technological Pedagogical Domain;

PEPD: - Pedagogical Educational Psychology Domain;

CEPD: - Content Educational Psychology Domain;

TCEPD: - Technological Content Educational Psychology Domain;

CTPD: - Content Technological Pedagogical Domain;

CPEPD: - Content Pedagogical Educational Psychology Domain;

TPEPCD: - Technological Pedagogical Educational Psychology Content Domain.

Figure 5.1 above illustrates that for a teacher to be regarded as fully trained; he/she needs a sound knowledge of subject content, and pedagogical, technological and educational psychology domains. A teacher could be so good when it comes to the content domain, but will not instruct well if he/she lacks the psychology of teaching tactics; he/she will fail to choose proper pedagogic and technological tools in accordance with the group diversity requirements of learners. Therefore, for authentic instruction and learning the four domains (content, pedagogy, technology and

educational psychology) need to harmoniously mesh together to enhance learner academic achievement.

The TPEPCD model can be adopted by teachers' training institutions to train, assess and critique student teachers in teaching practice, for the development of a teacher's professional repertoire for the educational requirements of the Fourth Industrial Revolution (Industry 4.0). Writing about the successful integration of computers for teaching and learning, as cited by the researcher above, Charalambos and Mcisaac (2010:129) state:

> Teacher education programmes play a crucial role. Teacher preparation on technologies should provide teachers with a solid understanding of the various media…Teacher preparation should not be based on training for "computer literacy", but should prepare teachers for using technologies to construct, represent and share knowledge in real life authentic contexts.

A teacher who commands excellent knowledge of educational psychology knows the degree of subject content to teach using relevant pedagogical and technological tactics in accordance with the psychological levels of development of his/her learners. Therefore, the researcher recommends that this proposed model be considered as it has the potential to improve teacher training in 21st Century skills that is, imparting subject content knowledge while simultaneously fostering cognitive, practical, and technological skills.

5.5 AVENUES FOR FURTHER RESEARCH

The researcher's preliminary suggestion for future research is that there is a need to note that this particular research concerned itself *only* with the use of computers as a tool for teaching and learning in secondary schools in Pinetown District, KZN province, South Africa. It is therefore suggested that similar research be carried out with specific reference to: (a) *primary schools*, so as to achieve a complete picture concerning computer usage across the curricula of both primary and secondary schools in KZN; (b) *practical* ways through which computers as a tool could be used

across the curricula. From literature reviewed and perceptions of research subjects, the computer is seen as an important supplementary pedagogical tool *in theory.* However, lack of attention to how *practically* it could be used was a glaring shortcoming that needs to be examined through more profound research.

In relation to the way forward for the DBE planners, it is recommended that urgent attention be paid to the teachers training curriculum with respect to integration of Computers in Education (Teaching & Learning) as a form of new pedagogy in the light of the looming of the Fourth Industrial Revolution.

5.6 LIMITATIONS OF THE STUDY

During the course of the study the researcher encountered some stumbling blocks such as transport problems. He found some of the learner participants who had already signed consent forms were absent because of transport problems, especially in the rural ward. This forced him to sometimes reschedule the administration of the interviews and lesson observations, which inevitably delayed the data collection process. However, the researcher made cordial adjustments to ensure capturing of the data required for the success of the research.

The researcher's study was also affected by time constraints. This was because of the protocol he was ethically supposed to follow; seeking permission to collect data could be too long and tedious. He was sometimes delayed as participant teachers could be attending to some urgent administrative issues delegated to them.

The study adopted a qualitative research method. The sampling method that was used was purposive sampling and the sample size was not very large. It consisted of 30grade 10 and 11 learners and six teachers in the Further Education and Training (FET) phase. Therefore, the findings of the study cannot be generalised to include the whole population.

Despite the limitations, the study was able to collect sufficient and valid data using semi-structured interviews for teachers, and semi-structured focus groups interviews with the learners. Triangulating data obtained from participants during observations of lessons in the classrooms could have promoted cross-validation of the findings.

5.7 CHAPTER SUMMARY

This chapter summarised the research findings, conclusions and corresponding recommendations and suggestions of “grey” areas that need further research. The objectives of the study were basically the exploration of both teachers’ and learners’ views about the use of computers as a tool for teaching and learning in secondary schools. Data gained from observing participants during lessons was triangulated with semi-structured interview data for both teachers and learners, to cross-validate the study findings. Generally, teachers and learners acknowledged that computers play an essential role in enhancing authentic teaching and learning, especially in view of the requirements of the Fourth Industrial Revolution. It was, however, discovered that through rampant theft of computers participants could not yield intended results using computers as a tool in the classroom. Recommendations and suggestions on the areas that require further research were also highlighted. In this regard, the TPEPCD model pertaining to the Fourth Industrial Revolution teacher’s professional repertoire was proposed for consideration by teacher training institutions by purposely embedding and integrating technological skills needed for the 21st Century.

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7. LIST OF APPENDICES

7.1 APPENDIX A: ETHICAL CLEARANCE CERTIFICATE

UNIVERSITY OF ZULULAND
RESEARCH ETHICS COMMITTEE
(Reg No: UZREC 171110-030)

RESEARCH & INNOVATION
Website: http://www.unizulu.ac.za
Private Bag X1001
KwaDlangezwa 3886
Tel: 035 902 6887
Fax: 035 902 6222
Email: MangeleS@unizulu.ac.za

ETHICAL CLEARANCE CERTIFICATE

Certificate Number	**UZREC 171110-030 PGD 2017/170**							
Project Title	**The use of computers as a tool in teaching and learning: A case study of secondary schools in Pinetown District**							
Principal Researcher/ Investigator	M Sikhakhane							
Supervisor and Co-supervisor	Dr S Govender		Prof MC Maphalala					
Department	Curriculum and Instruction Studies							
Faculty	Education							
Type of Risk	Medium Risk – Data Collection from people							
Nature of Project	Honours/4th Year		Master's		Doctoral	x	Departmental	

The University of Zululand's Research Ethics Committee (UZREC) hereby gives ethical approval in respect of the undertakings contained in the above-mentioned project. The Researcher may therefore commence with data collection as from the date of this Certificate, using the certificate number indicated above.

Special conditions:

(1) This certificate is valid for 3 years from the date of issue.
(2) Principal researcher must provide an annual report to the UZREC in the prescribed format [due date-01 July 2018]
(3) Principal researcher must submit a report at the end of project in respect of ethical compliance.
(4) The UZREC must be informed immediately of any material change in the conditions or undertakings mentioned in the documents that were presented to the meeting.

The UZREC wishes the researcher well in conducting research.

Professor Gideon De Wet
Chairperson: University Research Ethics Committee
Deputy Vice-Chancellor: Research & Innovation
03 August 2017

CHAIRPERSON
UNIVERSITY OF ZULULAND RESEARCH ETHICS COMMITTEE (UZREC)
REG NO: UZREC 171110-30
03 -08- 2017
RESEARCH & INNOVATION OFFICE

7.2 APPENDIX B: REQUEST FOR PERMISSION TO CONDUCT RESEARCH (CIRCUIT & PRINCIPAL)

University of Zululand
Faculty of education
Private Bag X1001
KwaDlangezwa
Empangeni
3886

15 May 2017

The Circuit Manager
Department of Basic Education
Durban North West Circuit
Pinetown

Dear Sir/Madam

REF: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

I am employed by the Department of Basic Education and currently teaching at Nqabakazulu Comprehensive Secondary school. I am currently registered for a Doctor of Education degree (D.Ed.) at the University of Zululand within the department of Curriculum and Instructional Studies. The topic of my research project is**: *The use of Computers as a tool in the Teaching and Learning: A Case study of Secondary Schools in Pinetown District.***

I wish to seek permission to conduct research in schools under Pinetown district in the Durban North West circuit. The educators who teach grades 10 & 11 and the learners that are in the mentioned grades will be used as participants to collect data for the study. The researcher will interview and observe six educators teaching in the five departments (Humanities, Science & Mathematics, Technical, Languages and Hospitality Studies) in the sampled schools in Kwamashu Central urban and Mafukuzela Gandi rural ward. The researcher will seek permission from the principals, then schedule an appointment with the educators and conduct the interviews and observations during their lunch breaks and contact times, and/or even after school, to minimize disturbance of the functionality of the school. Cordial request will be sought also from Heads of Departments and their teachers to organize learners for the focus group interviews which will take place during their lunch breaks.

I hope the findings of this study will benefit and assist the Department of Basic Education and educators teaching in Secondary Schools.

Yours faithfully

Mr. M. Sikhakhane (Student No.:201640080)

Contact numbers: 0794325958 (mobile) 031-5034808 (work)

Email: *munyaradzisikhakhane@gmail.com* & *munyaskeys@yahoo.com*

Dr S. Govender (Supervisor) Prof. M.C. Maphalala (Co-Supervisor)

University of Zululand
Faculty of education
Private Bag X1001
KwaDlangezwa
Empangeni
3886
15 May 2017

The Principal

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN GRADES 10 & 11

I am employed by the Department of Basic Education and I am currently teaching at Nqabakazulu Comprehensive Secondary school. I am currently registered for a Doctor of Education degree (D.Ed.) at the University of Zululand within the department of Curriculum and Instructional Studies. The topic of my research project is**: *The use of Computers as a tool in Teaching and Learning: A Case Study of Secondary schools in the Pinetown District.***

I cordially request for permission to conduct research in your school. The educators that teach Grades 10 & 11 and the learners in same grades will be used as participants to collect data for the study. The researcher requests to interview and observe two educators teaching grades 10 & 11 and learners from the mentioned grades will be interviewed in groups of five per grade during a focus group interview session.

The researcher will schedule an appointment with the two educators and conduct the interviews and observation at times convenient to the teachers and after school. With regard to learners, I shall consult with Heads of Departments together with their educators and necessary arrangements will be made which will be most convenient and suitable for the learners involved so as not to disrupt their other lessons.

I hope the findings of this study will benefit and assist the Department of Basic Education and educators teaching in grade 10 & 11.

Yours faithfully

Mr. M. Sikhakhane (Student No.:201640080)

Contact numbers: 0794325958/0620349271 (mobile);031-5034808 (work)

Email: munyaradzisikhakhane@gmail.com/munyaskeys@yahoo.com

Dr S. Govender (Supervisor) Prof. M. C. Maphalala (Co-Supervisor)

7.3 APPENDIX C: PERMISSION GRANTED TO CONDUCT RESEARCH (KZN HOD)

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma | Tel: 033 392 1041 | Ref.:2/4/8/1224

Mr M Sikhakhane
P55 Mkhiwane Road
KwaMashu
4360

Dear Mr Sikhakhane

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"THE USE OF COMPUTERS IN THE TEACHING AND LEARNING: A CASE STUDY OF SECONDARY SCHOOLS IN PINETOWN DISTRICT",** in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 19 May 2017 to 07 November 2019.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Connie Kehologile at the contact numbers below
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

Pinetown District

Dr. EV Nzama
Head of Department: Education
Date: 23 May 2017

...Championing Quality Education - Creating and Securing a Brighter Future

KWAZULU-NATAL DEPARTMENT OF EDUCATION
Postal Address: Private Bag X9137 • Pietermaritzburg • 3200 • Republic of South Africa
Physical Address: 247 Burger Street • Anton Lembede Building • Pietermaritzburg • 3201
Tel.: +27 33 392 1004/41 • **Fax.:** +27 033 392 1203• **Email:** Kehologile.Connie@kzndoe.gov.za/Phindile.Duma@kzndoe.gov.za •**Web:**www.kzneducation.gov.za
Facebook: KZNDOE….Twitter: @DBE_KZN….Instagram: kzn_education….Youtube:kzndoe

7.4 APPENDIX D: INFORMED CONSENT DECLARATION (TEACHERS, LEARNERS & PARENTS/GUARDIANS [ENGLISH & ISIZULU]

(D1) INFORMED CONSENT DECLARATION (Participant) (Teachers)

Project Title: The use of Computers as a tool in Teaching and Learning: A Case Study of Secondary schools in the Pinetown District.

The researcher is registered for the Doctor of Education (D.Ed.) degree at the University of Zululand, Department of Curriculum and Instructional Studies.

The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.
I am aware that:

1. The purpose of the research project is to understand the use of computers as a tool in the teaching and learning process across the curricula in secondary schools within the FET phase in the Pinetown District.

2. The University of Zululand has given ethical clearance to this research project and I have seen/ may request to see the clearance certificate.

3. By participating in this research project I will be contributing towards the improvement of the teaching and learning of subjects across the curriculum in grade 10 and 11 through integrating effectively the use of computers in my lesson.

4. I will participate in the project byparticipating in an interview and will be observed during my lessons related to the use of computers in the teaching and learning process across the curricula in grade 10 and 11.

5. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences.

6. I will not be compensated for participating in the research, but my out-of-pocket expenses will be reimbursed.

7. There may be risks associated with my participation in the project. I am aware that

a. the following risks are associated with my participation: information disclosure and identification of the participants

b. the following steps have been taken to prevent the risks: consideration of ethical issues.

c. there is no chance of the risk materialising.

8. The researcher intends publishing the research results in the form of journal article and forwarding them to the Department of Basic Education. However, confidentiality and anonymity of records will be maintained and that my name and identity will not be revealed to anyone who has not been involved in the conduct of the research.

9. I will receive feedback in the form of empirical findings and access to the copy of this report regarding the results obtained during the study.

10. Any further questions that I might have concerning the research or my participation will be answered by Mr Munyaradzi Sikhakhane on the following mobile number and email: 079 432 5958 oremail: *munyaradzisikhakhane@gmail.com/munyaskeys@yahoo.com*

11. By signing this informed consent declaration I am not waiving any legal claims, rights or remedies.

12. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I, ……have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project.

…… ……

Participant's signature **Date**

(D2) INFORMED CONSENT DECLARATION
(Participant) (Learners)

<u>Project Title</u>: The use of Computers as a tool in Teaching and Learning: A Case Study of Secondary schools in the Pinetown District.

The researcher is registered for the Doctor of Education (D.Ed.) degree at the University of Zululand, Department of Curriculum and Instructional Studies.

The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.
I am aware that:

1. The purpose of the research project is to understand the use of computers as a tool in the teaching and learning process across the curricula in secondary schools within the FET phase in the Pinetown District.

2. The University of Zululand has given ethical clearance to this research project and I have seen/ may request to see the clearance certificate.

3. By participating in this research project I will be contributing towards the improvement of the teaching and learning of the different subjects in grade 10 and 11.

4. I will participate in the project by participating in a focus group interview and answering questions related to the use of computers as a tool in teaching and learning at my school.

5. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences.

6. I will not be compensated for participating in the research, but my out-of-pocket expenses will be reimbursed.

7. There may be risks associated with my participation in the project. I am aware that

a. the following risks are associated with my participation: information disclosure and identification of the participants
b. the following steps have been taken to prevent the risks: consideration of ethical issues.
c. there is no chance of the risk materialising.

8. The researcher intends publishing the research results in the form of journal article and forwarding them to the Department of Basic Education. However, confidentiality and anonymity of records will be maintained and that my name and identity will not be revealed to anyone who has not been involved in the conduct of the research.
9. I will receive feedback in the form of empirical findings and access to the copy of this report regarding the results obtained during the study.

10. Any further questions that I might have concerning the research or my participation will be answered by Mr. Munyaradzi Sikhakhane on the following mobile number 079 432 5958 and or email: munyaradzisikhakhane@gmail.com & munyaskeys@yahoo.com

11. By signing this informed consent declaration I am not waiving any legal claims, rights or remedies.

12. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I, ……have read the above information/ confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project.

…… ……

Participant's signature **Date**

(D2.1) INCWADI EVEZA IGUNYA LOMZALI UKUTHI UMNTWANA ABAMBE IQHAZA OCWANINGWENI (Umzali noma onegunya lokunakekela umntwana)

Isihloko:**Ukusetshenziswa kwama Khompuyutha ekufundiseni kanye nokufunda: Ucwaningo lwezikole zamabanga athe thuthu kwisifundazwe sasePinetown.**

Umcwaningi: **Mr. Munyaradzi Sikhakhane**

Uphiko: **Umnyango wohlelo lokufunda nokufundisa.**

Lona obhalwe ngenhla ufaka isicelo sokuba umntwana ahlanganyele ocwaningweni olwenziwayo olumayelana nesihloko esibhalwe ngenhla.

Ngichazelekile ngenhloso yalolu cwaningo nangenhloso yokusayina lelifomu ngolimu engiluqondayo.

Ngiyaqonda ukuthi:

1. Inhloso yalolu cwaningo:imibono yothisha nabafundi engasiza abafundi bebanga leshumi neleshumi nanye ukuze bakwazi ukwenza ngcono.

2. I-University of Zululand iluvumele lolu cwaningo.

3. Ngokuzibandakanya nalolu cwaningo umntwana wami angasiza ekwakhiweni kwemibono ezosiza othisha nabafundi bebanga leshumi neleshumi nanye ukuze bakwazi ukwenza ngcono ezifundweni zabo.

4. Umntwana wami uzozibandakanya kulolu cwaningo ngokuphendula imibuzo efuna ulwazi ngesihloko esibhalwe ngenhla.

5. Umntwana wami uzivumele yena ukuba ingxenye yalolu cwaningo.

6. Uma engasathandi ukuba ingxenye yalo, uyohoxa engalindele zinkinga ngokuhoxa kwakhe.

7. Umntwana wami angacelwa ukuthi ahoxe ngaphambi kokuphela kocwaningo uma umcwaningi noma ubani omunye ophathelene nalo ebona kufanele.

8. Mina nomntwana wami asilindele kuhola ngokuba kulolu cwaningo.

9. Angilindele bungozi obungahambisana nalolucwaningo, kodwa uma imibuzo ngandlela thize iphazamisa umoya womntwana wami, umncwaningi ukulungiselele lokho ngokusebenzisana nabaluleki abazoba kanye naye ngesikhathi socwaningo.

10. Umcwaningi uyolushicilela lolucwaningo lube umqingo wencwadi eqikelela ukuthi igama lomntwana wami, nemininingwane yakhe kuyohlala kuyimfihlo.

11. Ngingathanda ukuzwa ngemiphumela yocwaningo ngokufunda lowo mqingo oshicilelwe.

12. Imibuzo engingaba nayo mayelana nalolu cwaningo iyophendulwa umcwaningi uqobo.

13. Ngokuzinikela kwami ekusayineni leli fomu angizibophezeli ekutheni ngingethathi izinyathelo okungaba ezomthetho noma ukunxeshezelwa komntwana wami.

14. Ngizogcina ikhophi yaleli fomu lokuzibophezela

Mina.....ngiyavuma ukuthi ngiyifundile yonke imininingwane ekulelifomu futhi ngichazelwe yona ngolimi engiluqondayo.Ngiyakuqonda okubhalwe kulelifomu.Ngibuze yonke imibuzo ebengingabanayo ngaphenduleka ngendlela engenelisayo.Ngiyakuqonda konke okulindeleke kimi ngalolu cwaningo.

Angifakwanga ingcindezi, ngizingenele mina ngokuthanda lolucwaningo.Ngokusayina ngiyazivumela mina ukuthi umntwana wami u.....oneminyaka eyi.....angazimbandakanya nalolu cwaningo.

Ukusayina.....

Usuku.....

(D2.2) INFORMED CONSENT DECLARATION

(Parent or Guardian)

Project Title: The use of Computers as a tool in Teaching and Learning: A Case Study of Secondary schools in the Pinetown District.

Mr Munyaradzi Sikhakhane from the University of Zululand, Faculty of Education Department of Curriculum and Instructional Studies has requested my permission to allow my child to participate in the above-mentioned research project. The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

1. The purpose of the research project is to understand the use of computers as a tool in the teaching and learning process across the curricula in secondary schools within the FET phase in the Pinetown District.
2. The University of Zululand has given ethical clearance to this research project and I have seen/ may request to see the clearance certificate.
3. By participating in this research project my child will be contributing towards developing policy recommendations that may benefit all stakeholders concerned.
4. My child will participate in the project by participating in a focus group interview by answering questions in a group of five without prejudice.
5. His/ her participation is entirely voluntary.
6. If he/ she at any stage wish to withdraw from participating further, he/ she may do so without any negative consequences.
7. He/she can be withdrawn at any time from the project before the project finish, if he/she decides to do so.
8. My child and I will not be compensated for participating in the research, but his/ her out of pocket expenses will be reimbursed.
9. I understand that the foreseeable risks associated with this study are minimal. These risks are similar to those associated with the disclosure of work related information of others. The researcher has assured me of confidentiality and anonymity in regard to the dissemination of any information to others.
10. The researcher intends publishing the research results in the form of a dissertation, however, confidentiality and anonymity of records will be maintained and that my name and identity will not be revealed to anyone who has not been involved in the conduct of the research.

11. I will appreciate to receive feedback regarding the results obtained during the study by reading the published research document.
12. Any further questions that I might have concerning the research or my participation will be answered by Mr Munyaradzi Sikhakhane on the following mobile number and email: 079 432 5958 or email: *munyaradzisikhakhane@gmail.com*/*munyaskeys@yahoo.com*
13. By signing this informed consent declaration I am not waiving any legal claims, rights or remedies.
14. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I …….. have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project. By signing this form I give permission for my child (name) ……...age…….to participate in the research project.

_____ _____

Parent / Guardian signature Date

7.5 APPENDIX E: SEMI-STRUCTURED INTERVIEWS (EDUCATORS)

INTERVIEW SCHEDULE (EDUCATORS)

SECTION A: BIOGRAPHICAL INFORMATION

1. State your years of overall teaching experience.
2. How many years have you taught in the FET phase?
3. Do you have any computer related qualifications? Explain

SECTION B: CLASSROOM PRACTICE

1. Have you ever used a computer as a tool in the teaching and learning process? If 'YES', could you describe the kind of work you used the computers for. If 'NO' what have you seen as prohibiting factors in this regard?

2. How many times, approximately, do you use computer tools such as Internet, Email and/CD ROM materials in your teaching and learning process per week or month and so on? Please briefly explain why you use the computer this number of times?

3. Do you consider the use of the computer as an important supplementary pedagogical tool in your teaching and learning process? Please briefly explain improvements brought about by using computers.

4. How have you encouraged learners in making use of the computer as a tool during the teaching, learning and assessment process?

SECTION C: EDUCATOR CHALLENGES & SUPPORT

5. What do you see as challenge(s) you are encountering/have encountered in trying to use computers as a tool in the teaching and learning process?

6. What kind of support, are you getting from SGB, SMT, parents, colleagues, unions, DBE and donors to ensure effective use of computers in your school?
7. Can you suggest some improvements that you feel should be done in future so that every teacher could comfortably integrate computers as a tool in the teaching and learning process?

8. **NB:** Do you have any additional comments/suggestions you may have on how best we can use computers as a tool to enhance effectiveness in the teaching and learning process in secondary schools in Pinetown district?

7.6 APPENDIX F: SEMI-STRUCTURED FOCUS GROUP INTERVIEWS (LEARNERS)

INTERVIEW SCHEDULE FOR LEARNERS

SECTION A: COMPUTER USAGE IN THE LEARNING PROCESS

1. Have you ever used a computer as a tool in your learning process? If 'YES', could you describe the kind of work/subject you used the computers for. If 'NO' what have you seen as prohibiting factors in this regard?

2. How many times, approximately Internet, Email and/CD ROM facilities in your learning process per week or month and so, on have you made use of the computer? Please briefly explain why you use computers this number of times.

3. Do you take computer use as an important tool to learn better in all your subjects? Please briefly explain improvements brought about by using computers specifying subjects where you mostly use computers.

4. Briefly explain how computers promote sharing of learning information amongst your peers. Specify computer tools you use, and/have used, such as Google, Emails, etc.

SECTION B: LEARNER CHALLENGES & SUPPORT PROVIDED

5. What do you see as challenge(s) you are having/have in preventing you from trying to use computers as a tool in your learning?

6. What kind of support, are you getting from SGB, SMT, teachers, parents, peers, DBE and donors to ensure that effective use of computers in your school/

7. Can you suggest what you feel should be done in future so that you can have access to computers with relevant subject software for effective learning of all subjects you do?

8.**NB:** Do you have any additional comments/suggestions you may have, as learners, on how best we can use computers to ensure that you learn effectively and eventually achieve good passes schools in Pinetown district?

7.7 APPENDIX G: PARTICIPANT OBSERVATION SCHEDULE

CLASSROOM OBSERVATION SCHEDULE

SUBJECT:		**DURATION OF PERIOD:**	
DATE:		**LEARNER-COMPUTER RATIO**	

ASPECTS OBSERVED	**OBSERVATIONS/COMMENTS**
1. Was the computer access adequate to meet the lesson objectives?	
2. Was the usage of the computer as a tool appropriate for the learner's skill level?	
3. What purpose did the computer usage as a tool serve during the lessons? • Accessing information (input) • Processing information (process) • Producing/presenting/communicating information (output)	
4. Does the lesson enable learners to make use of computer actively engaging them in higher order thinking skills?	
5. How does the educator teach and guide the learning process during the lesson?	
6. How does the educator monitor and supervise learner computer usage during the lesson?	
7. How does the computer as a tool enable learners to collaborate with each other throughout the lesson activities?	
8. How does the computer as a tool allow learners to interact and engage with the information in a meaningful manner during the lesson?	
9. To what extent did the educator prepare for the use of computer as a tool during the lesson?	
10. Did the use of the computer as a tool extend learners beyond the classroom?	

7.8 APPENDIX H: COPY OF PLAGIARISM REPORT

The use of Computers as a Tool in Teaching and Learning: A Case Study of Secondary schools in the Pinetown District.

ORIGINALITY REPORT

8%	7%	3%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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7.9 APPENDIX I: LETTER FROM THE EDITOR

CERTIFICATE

This is to certify that I edited Munyaradzi Sikhakhane's doctoral thesis in Curriculum Studies entitled *The Use of Computers as a Tool in Teaching and Learning: A Case Study of Secondary Schools in the Pinetown District.*



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