TEACHER PRACTICES IN THE TEACHING OF TECHNOLOGY IN THE SOUTH AFRICAN SCHOOLS CURRICULUM: A MULTIPLE CASE STUDY

By

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ABSTRACT

Since technology is a whole new learning area, it is imperative for teachers to go through training of the content for effective teaching of the subject. Workshops and interventions will also assist in the content enrichment throughout their teaching experience. Through all these attributes teachers will acquire the subject matter knowledge in context. The term technological knowledge refers to the teachers’ knowledge of activities and concepts which relates to the body of content. In applying technology education, it is important to understand wherever there are consistencies in teaching practices and the events that are actually happening in the classroom.

In the context of the above, technology education requires a teacher to be well versed with curriculum content as well as the appropriate teaching practices. When technology education was introduced, most teachers were expected to use technology in schools without being adequately trained in the content or even instructional methodologies. The circumstance could result in a situation where teachers have to teach certain concepts without the necessary knowledge and/or self-confidence about teaching topics.

The purpose of this study is therefore to: investigate teachers’ understanding of selected technology concepts; and get insight into teachers’ skills and knowledge in technology education. The aim is to explore teachers’ teaching practices such as learning strategies used, as well as how they integrate technology in the classroom settings. A qualitative approach was used to gather data from the teachers. Three teachers participated in the study. It further emerged from the findings that the participants believed that providing definitions of the technology concepts is imperative for the learners to acquire the knowledge with ease. Of the three educators interviewed, it was noted that only one of them exposed learners to practical exercises and this was because there were no funds to acquire the materials for experiments. The researcher observed during the lessons that educators depend mainly on showing learners’ pictures in class, in contrast to the actual experiments, and the participants believed that learners learn best when they do hands-on activities.

Of the three educators interviewed, they all first taught technology education without appropriate qualifications and it also emerged that only one provided practical work to the learners. Very important to note is that those educators without technology-related
qualifications are struggling to understand some of the concepts and as such it makes the whole teaching process a problem.

Findings revealed that the teachers used question and answer method to teach the learners. They observed that the teacher asked questions throughout the lesson and feedback was given to the learners. Teachers agreed that they lack an appropriate teaching methodology for teaching technology education. This means that teaching might be compromised due to the fact these teachers would have no effective strategies to teach this subject effectively. It could be concluded that there are challenges facing teachers in their teaching practices. This is characterised by lack of subject knowledge, lack of resources, and an inadequate methodological approach to teaching technology.
DECLARATION BY CANDIDATE

I hereby declare that the dissertation submitted for M. Ed.: Technology Education at Tshwane University of Technology is my own original work and has not previously been submitted to any other institution of higher education. I further declare that all sources cited are indicated and acknowledged by means of a comprehensive list of references.

PMA Moeletsi

Date: 09January 2017
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Here I would like to thank Dr TDT Sedumedi who is my supervisor in this work, for his guidance, encouragement, support and much appreciated contributions towards my work, as well as towards my character development as a student. Furthermore thanks to my family, friends and colleagues who contributed and influenced me in their own respective ways.
DEDICATION

I would like to dedicate this work to the following individuals in order of importance for their continuous support, encouragement and love during my studies;

a) My son Tshepiso

b) My two daughters Tshireletso and Tshiamiso

c) My friends, colleagues and fellow students

To all of the above, thank you.
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CHAPTER 1
ORIENTATION OF THE STUDY

1 INTRODUCTION

A need for teaching technology in grade 9 classes has become a priority for many countries around the world. Technology can be characterised as more of an activity than a discrete body of content (William, 2000, p.48). In terms of technological knowledge, this concept can however be divided into procedural knowledge, which essentially encompasses the activity, and conceptual knowledge, which relates to the body of content (Williams, 2000, p48). Williams (2000, p.48) attests that these concepts are imperative to assist teaching to be effective in the classroom settings. In applying technology education, it is important to understand wherever there are consistencies in teaching practices and the events that are actually happening in the classroom.

In the context of the above, technology requires a teacher to be well versed with curriculum content as well as the appropriate teaching practices (Engelbrecht, Ankiewicz & Swardt, 2007, p.580). Engelbrechtet al. (2007, p. 580) argue that most teachers were expected to use and teach technology in schools without being adequately trained in the content or even instructional methodologies. The situation could result in a situation where teachers have to teach certain concepts without the necessary knowledge and/or self-confidence about teaching topics (Engelbrechtet al., 2007, p.580).

The purpose of this study is therefore to explore teachers’ understanding of selected technology concepts in order to get insight into their teaching skills and knowledge of technology in grade 9 classes. That is, to understand teachers’ teaching practices such as learning strategies used, as well as the integration of technology in the classroom settings.
1.1 BACKGROUND AND RATIONALE

Technology was introduced as a teaching and learning subject for the first time in South Africa in 1998 as part of the national outcomes-based education curriculum. Due to the limited time frame for the implementation, there was little time to train teachers earmarked to teach technology. As a result of the fast-tracked training, most of the grade 9 teachers were ill equipped to operate within technology education settings and lack of necessary conceptual and procedural knowledge still remains a concern.

Through well-developed curricula, technology programmes are able to enhance academic content and higher order of thinking skills (Jones & Moreland, 2004, p.122). The curriculum transformation in South Africa was initiated after the inauguration of the democratic government in 1994. There have been many debates about the implementation of the new curriculum and how it was implemented. Teachers across all grades went through workshops to expose them to the new curriculum (Jones & Moreland, 2002, p.122). Currently teachers still encounter some challenges across all grades. Some of the challenges faced by educators range from: (i) integration of teaching, learning and assessment as a result of lack of clarity and confidence in terms of assessment policies; (ii) inadequate teacher development. With all these facts in mind, technology is concerned with developing learner technology literacy through the investigation and solving of complex technology-related problems that are associated with multiple conceptual, procedural, societal and technical variables (Jones & Moreland, 2004, p.122).

Technology is a whole new learning area, with unique content which is unfamiliar to most of the teachers. It consists of broad themes such as structures, materials, systems and controls. Engelbrecht et al. (2007, p.587) attest that many teachers lack experience in the respective themes of technology. Essentially, these teachers lack necessary competencies to facilitate technology properly.

In order to adhere to technology, it is imperative to be conversant with technological literacy (Lewis, 1999, p.43). This essentially means that teachers ought to be technologically literate, which means that they should understand the nature of technology, appropriate utilization of technological devices, and processes. Understanding of these constructs is likely to ensure effective and efficient technological practices. In the context of this, it is imperative to understand what the teachers of technology do in their respective classroom settings; their
professional knowledge of technological constructs; and the contextual factors that impact on how they perform, require to be examined. Furthermore, teachers should be conversant with technological concepts such as design. According to Cajas (2002, p.180), design has been identified as an essential part of technology practices, and this is an appropriate strategy for learners’ education. Strategy refers to the methodologies used to teach. Based on the background provided, the rationale for the study is to explore teachers’ teaching practices in the wake of limited or lack of relevant skills required in teaching technology.

1.2 PROBLEM STATEMENT

Despite various interventions implemented since the implementation of technology, there seem to be lack of content knowledge, and appropriate instructional methods among grade 9 teachers. Concerns have been raised about pre-service teachers’ lack of knowledge and skills, confidence, and motivation in integrating technology in their teaching activities (Huang, Lubin & Ge, 2011, p.1200). Technology is a relatively new subject in the South African school education system. The curriculum changes are a challenge to most teachers, especially those who do not have qualifications in the area of technology. The continuing professional teacher development aimed at empowering unqualified teachers and further develop qualified teachers at all levels in the education service (Engelbrecht, 2007, p.582). In light of factors stipulated as challenges to teaching by many of the teachers, the study aims to explore how teachers, despite their limitations, engage in the process of technology education. Teachers were expected to implement technology in schools without adequately being trained in content or instructional methodology (Engelbrecht et al., 2007, p.980)

1.3 RESEARCH QUESTIONS

Main Research Question

What are teachers’ teaching practices when teaching technology concepts?

Research Sub-questions

- What are teachers’ understandings of selected technology concepts?
- How do teachers teach particular topics and concepts of technology?
1.3.1 Justification and explanation of research sub-questions

- **What are the teachers’ understandings of selected technology concepts?**

From literature, it emerged that some grade 9 teachers struggle to teach the subject, and they are further not conversant with some technology concepts. A concern has been raised that the Higher Education sector, colleges and non-government organisations were not adequately involved in the training process (Engelbrecht et al., 2007, p.851). Lack of knowledge of the technology concepts creates a barrier for self-confidence to teach the subject. The technology teachers seem to be ill-equipped to function within the new curriculum system and, as such, they lack the necessary insight regarding the different content areas within technology, for instance, processing, structures, systems and controls. This question was aimed at establishing teachers’ understanding of some of the concepts they encounter in their teaching.

- **How do teachers teach particular topics and concepts of technology education?**

In some instances, teachers are using traditional teaching methods to teach technology. Using inappropriate methods might be problematic, as they may not allow other activities such as group work. Importantly teachers prefer the traditional teaching methods due to the fact that they were trained in such methodologies. At some stage teachers are faced with constraints, such as a lack of laboratories, materials and so on to teach technology. This could result in situations where teachers are unable to integrate technology concepts in their classroom practices. This type of subject should afford learner to develop their own design and models. In this case, learners should be allowed to come with their own initiatives and solutions. This question was aimed at establishing links that teachers make between the concepts they teach and the strategies they apply.

1.4 AIMS AND OBJECTIVES OF THE STUDY

The primary aim of the study was to investigate the teaching practices of teachers in offering technology in grade 9 classes and to determine how these teaching practices are developed to enhance learning of selected concepts within particular topics. The following objectives are set for the study:

- To explore teachers’ knowledge on selected technology concepts.
- To establish the teaching practices as implemented by teachers.
As teachers teach in different contexts, their practices should to a large extent be impacted by contextual factors such as their knowledge, their learners and the resources available to them.

1.5 RESARCH DESIGN AND METHODOLOGY

In this section, the design, population and sampling, data collection and analysis are discussed.

1.5.1 Research design

The design of this study is qualitative and explorative in nature. Its qualitative nature offers the opportunity to uncover the methodologies applied by educators in teaching technology, and their experiences (Creswell, 2009, p. 156). The purpose of exploration is to gain in-depth understanding of the experiences of the teachers and the strategies they use to offer the subject under investigation. To implement this, inductive approaches were applied. These approaches rely on the use of qualitative data collection methods to gain a deep understanding of the factors and nature of the main issues or research problem (Silverman, 2004). According to Silverman (2004, p. 188), on undertaking qualitative research, the actual process is in reality both iterative and inductive. In addition, Creswell (2007, p.37) posits that qualitative researchers collect data at the site where the participants experience the issue or problem under study.

1.5.2 Population and sampling

The population of the study consisted of teachers teaching technology from different schools in grade 9 classes. For the purpose of this study, three teachers [N=3] were selected from different schools to take part in the study. The research was conducted in Nokaneng and Mmamatlhakecuicuits of the Mpumalanga Department of Education. The three cases focused on this study were sampled from the thirty participants who took part in answering the questionnaires from the workshop. The workshop was conducted in Marapyane circuit at Khamane High School. All the three circuits are situated within Nkangala district in the broader J.S Moroka municipality. The participants were selected purposively to take part in the study. According to Polit and Beck (2008, p.339), sampling refers to the process of selecting a portion of the population so that inferences about the population can be made. In using purposive sampling, the researcher is of the opinion that it enables a choice of participants to provide relevant and rich data.
1.5.3 Data collection

Data gathering method used in the research study included direct observations, open ended questionnaires and semi structured interviews.

The researcher decided on direct observation as one of the data gathering method due to the fact that certain information can best be obtained through direct examination by the researcher. This direct observation was directed at how grade 9 teachers teach a particular topic under investigation. The procedure for collecting data was conducted by using checklist, which focused on the interaction between teacher and learner, as well as teaching methods used. Accordingly, observation notes give an account of what happened, providing little or no interpretation. The researcher made field notes as an observation tool and wrote a narrative of the behaviour she observed. Field notes should contain a chronological description in categories of what happened to the settings and the participation (Grinnel&Unrau, 2008, p.232). During the observation the researcher recorded a full description as possible of the researcher’s teaching practices and responses during the lesson.

An interview is an oral type of a questionnaire. As a research method however, the interview cam be viewed as more than an exchange of small talk. Semi-structured interviews were used to collect data from the participants, namely teachers teaching in grade 9 classes. A prototype for the interview was developed in consultation with three academics from different schools within Nokaneng and Mmametlhake circuits of Nkangala district in Mpumalanga province. This method is appropriate because it affords the researcher opportunity to explore the subject under investigation to get in-depth data from the participants and even the participants are at liberty to give more experiences during the interviews. An in-depth interview is a one on one interview between the researcher and the research respondent (DePoy& Gilson, 2008, p.149). The researcher used one on one interviews to capture information and to gain the in-depth understanding of technology concepts. The researcher used a digital voice recorder to record teachers’ verbalisations of the entire semi-structured interviews. A written record of what was said was composed for the purposes of data analysis (Cresswell, 2003). The researcher took only few important notes, as it was easier to review the answers the answers and ask probing questions at the end of the interview.
Questionnaires were drawn up using open-ended questions. The choice of the open-ended questionnaire is that the open-ended or unrestricted type of questionnaire calls for free response in the respondents’ own words. Questionnaires were delivered to all respondents personally so as to ensure that each one received a copy of the questionnaires. Each respondent was given enough time to complete the questionnaire and personally urged to submit/return it. According to McMillan and Schumacher (2010, p.195) the main reason for choosing a questionnaire was that it contains the same questions for all subjects and can ensure anonymity. Furthermore, observations and questionnaires were used to triangulate data sources. Sufficiency of data collected was dependent on data saturation.

1.5.4 Data analysis

Data analyses involve reducing data into manageable elements after collection (Cooper & Schindler, 2003, p.87). The collected data was transcribed and content analysed according to themes and categories and then coded. This was done by looking for the main ideas, which were then put into categories. This process was guided by Creswell’s (2009) six steps approach to data analysis that consists of (i) transcribing the interviews, (ii) reading through all the data, (iii) coding data, (iv) generating themes, (v) advancing how themes will be represented in the qualitative narratives and (vi) interpreting the meaning of the data (p.185).

1.6 ENSURING TRUSTWORTHINESS

To ensure trustworthiness, the framework of Lincoln and Guba (1985, p.313) was followed. This included credibility, transferability, dependability and conformability. Trustworthiness was achieved by prolonged engagement, triangulation, peer debriefing, and the authority of the researcher and by using an independent coder (Creswell, 2009, p.191; Babbie & Mouton, 2008, p.168).
1.7 ETHICAL CONSIDERATION

As regard to ethical issues, the researcher ensured that principles of ethical consideration were adhered to. Firstly the Department of Basic Education was informed by sending a research letter to request permission. Secondly the district research approval letter was send to the principals of schools to arrange for an appointment. Thirdly the participants were informed that participation in the study was voluntary and if they were willing to participate, they were free to withdraw if they felt uncomfortable during the interview. Their anonymity was ensured since no personal identifiers were used in the study. Above all, the participants were given consent letter to read, and if they were content with the study, they gave permission to proceed with the interviews.

1.8 SIGNIFICANCE OF THE STUDY

The study is likely going to have some significance in that it will help teachers formulate appropriate teaching practices for, and enhance their relevant re-curriculation processes of the subject. The Department of Basic Education as well as the subject specialist would be able to understand the practices implemented at respective schools. They will be able to initiate improvement plans and be able to provide effective and efficient interventions to best teach technology.

1.9 DEFINITION OF KEY TERMS

**Conceptual knowledge:** is defined as the facts, concepts, principles and procedures that are taught in school classrooms. This knowledge is assumed to be interconnected in nature, it is influenced by beliefs and it is said to be personally integrated (Gess-Newsome, 1999).

**Learning:** is a process whereby knowledge is created through the transformation of experience (Kolb, 1984, p.21). In this case, the definition as such emphasizes a number of fundamental aspects associated with the learning process and viewed from the experiential perspective. Kolb (1984, p.21) identified three aspects of learning. First, it is an emphasis on the process of adaptation and learning, as opposed to content or outcomes. Second is that learning is a transformation process, being continually created and recreated, not an independent entity to be acquired. This means that the process of learning continuously evolves, and with changes in focus. Third, learning usually transforms experience in both its objectives and subjective forms.
Technology: is defined as a form of human knowledge aimed at creating artefacts (Pavlova, 2005, p.122). Technology is concerned with developing learners’ technological literacy through the exploration and solving of complex and interrelated technological problems that involve multiple conceptual, procedural, societal and technical variables (Jones & Moreland, 2004, p.122). It affords opportunities for learner-control, increased motivation, innovation and connections to the real world. Finally, technology is concerned with what can or should be, through the modification of the natural world to meet human wants and needs.

Technology literacy: refers to one’s ability to use, manage, evaluate and understand technology (ITEA, 2000/2002/2007)

Pedagogical Content Knowledge: Effective teaching is enabled by the PCK of teachers and a special blend of content knowledge that is built up over time and through experience (Williams, 2012, p.34). It is a form of practical knowledge that is used by teachers to guide their actions in a classroom setting. Pedagogical Content Knowledge framework consists of four dimensions: (i) the first dimension relates to the teacher’s knowledge about the purpose of teaching which is reflected in teachers’ goals. (ii) Second, the dimension that incorporates the teacher’s knowledge of the students’ understanding of the subject matter. In this regard, teachers should be aware of what a learner already knows, as well as having knowledge of the subject matter that is likely to be challenging and needs further development. (iii) Third, the dimension that refers to the teacher’s knowledge of instructional strategies or methodologies for teaching specific topics. (iv)Fourth, the dimension that relates to teachers’ knowledge about the curriculum content, as well as knowledge of the specific content required for a given cohort. The study will be grounded on this model. The four dimensions are imperative in ensuring viable teaching practices in South African schools.

Technology education: it is an integrated experience-based instructional programme designed to prepare students to be knowledgeable about technology, its evolution, systems, technologies and its usage. Students are challenged to discover, create, solve problems and construct solutions by using a variety of tools, machines, materials and computer systems.
1.10 CHAPTER OUTLINE

Chapter 2 focuses on a literature review with specific reference to technology.

This chapter focuses mainly on the technology teaching practices, pedagogic knowledge, content knowledge, and challenges teachers face in the offering of the subject.

Chapter 3 discusses the research design and methodology used in the study. Population and sampling technique were discussed. Further discussion was undertaken on the data collection and how collected data was analysed.

Chapter 4 essentially, presents and discusses the results of the study.

Chapter 5 discusses conclusions and recommendations of the study.

1.11 SUMMARY

This chapter gave a background and introduced the problem statement of the study. The research objectives were articulated as well as the methodology employed in the study. In this chapter, trustworthiness was also discussed to ensure that the findings of the study are credible and dependable. Furthermore, another important aspect covered in this chapter is the ethical consideration where institutional permission was requested from the Department of Basic Education Regional office at district office, as well as communicating with the principals of the identified schools about the study. The next chapter presents a literature review on technology as well as related concepts.
CHAPTER 2
TECHNOLOGY EDUCATION PERSPECTIVES

2 INTRODUCTION

There is widespread conversation that for teachers to be effective in their teaching practices, it is imperative that they are versed with subject knowledge and understanding of different teaching methods. Cabrera and La Nasa(2002) define effective teaching “as one that produces demonstrable results in terms of the cognitive and affective development of the students” (p.13). In this chapter a discussion was undertaken on issues relating to teaching practices. Key issues discussed included among others, technology, technology concepts, technology education, pedagogic content knowledge, as well as theories associated with teaching practices.

2.1 TECHNOLOGY

Moersch(1995, p.40) attests that since the introduction of the IIe computer, technology has become a buzz word and has presented a broad range of interest amongst researchers and pupils. In the school system worldwide, technology has been embedded as a school subject. More importantly, technology has essentially complemented a conventional instructional curriculum and emphasis on teaching trajectory. According to Blomdahl and Rogala (2008, p.19), technology has become a compulsory subject in schools and it is aimed at developing learners to work in projects to solve real life problems and to create technology awareness. Blomdahl and Rogala (2008, p.19) further posit that the capabilities of learners should be to acquire concrete content within the technology subject. In this respect, in the quest of shaping the technology subject, usually meaning is created and both theory and practice are interwoven in the process of learning (Blomdahl & Rogala, 2008, p.19). If learners learn by doing even if they do not focus, perhaps on issues such as artefacts like engineering learning, they will however, gain insight and knowledge about the function of technology. Jones and Moreland (2004, p.122) posit that the advancement of technology has three aspects namely (i) the nature of technology (ii) dimensions of learners’ technological practices, which relates to the operationalisation of conceptual and technical variables in the learners’ activities, and (iii) generic and specific conceptual, procedural, societal and technical dimensions. This means
that learners should first learn the theoretical aspects and henceforth, they should be able to apply what they have learnt in a practical manner.

In this regard, teaching, learning and assessment should be applied consistently with the stipulated dimensions. Blomdahl and Rogala (2008, p.20) further argue that there are three goals for technology as a subject. First, promotion of technological awareness; with this goal the intention is to create awareness which involves technological knowledge, for instance the construction and effects of artefacts and the functioning of the technical system. Technological awareness is about understanding technological environment. Second, learners should improve the capability to create knowledge. In this case, the learners should however develop their own capabilities in conjunction with changes in social and working life. With the changes taking place, it is imperative for learners to get educational support to withstand changes (Blomdahl & Rogala, 2009, p.20). Third, they should develop the power of communication. In this regard, communication can assist in terms of presentation techniques, for instance, images, models and so on. The two authors believed that powers of communication enhance learners’ awareness of technological environment and capability of being able to solve real life situations. According to Dugger, (2008, p.2), technology is concerned with what can or should be, through modification of the natural world with the view of human wants and needs and this extends the abilities to change the world.

It is a fact that technology is imminent in terms of advancing effective learning. Asunda (2012, p.47) indicates that technology seeks to develop new knowledge by extending abilities to change the world and put together material pieces to satisfy needs. In putting materials together, technological literacy is important, that is, the ability to use, manages, assess, and understand technology. Asunda (2012) describes the technologically literate person as someone who; “(i) ...should have certain basic knowledge about technology, (ii) ...should have some basic technical capabilities, for instance, being able to work with a computer and to identify and fix some of the problems in the devices” (p.47).

Technology affords opportunities for learner-control, increased motivation, and connections to the real world. Earle (2002, p.7) attests to the fact that technology generates a glut of information, but has no particular pedagogic wisdom, particularly with new breakthroughs in cognitive science about how learners should construct their own meaning for deep understanding to happen. This imperatively suggests that teachers need to be expert in pedagogic design. The use of technology in class is imperative. The use of technology in
class depends on two important factors, namely, self-reporting of teachers and the technological instruments. In considering the self-reporting practices, there is a lack of understanding of how teacher beliefs about instruction and attitudes towards technology affect the routine integrating technology (Judson, 2006, p.583).

There has been an increasing pressure worldwide from industries to change the manner in which learners are educated in technology, so that they are better prepared for world of work. This should however not start at institutions of higher learning but rather at pre-university level. The context of this change is premised from the rapid speed of technological development, the notion of doing more with less, and the fact that technology is linked to economic prosperity (Hepburn & Gaskell, 1998, p.777). Contextual change has always been a problem, despite continuing efforts on the part of academics, researchers, teachers and policy makers. The apparent problem has been getting an official curriculum to be taken up by teachers and implementation thereof in schools in such a way that it is faithful to the intentions of the initiators and policy makers (p.778).

2.2 TECHNOLOGY LITERACY

According to Dugger,(2008, p.3), technological literacy relates to one’s ability to use, manage, evaluate and understand technology and how it works. In order to be more technological literate, one needs to fully understand what technology is, how it works, how it shapes the society. Notably, a person who is technologically conversant has some abilities to “do” technology that enables one to use their creativity to design and build things and solve real life problems that are more technological in nature (Dugger,2008,p.3). A person who is technologically literate should essentially possess attributes such as being comfortable with and objective when using technology. Once one is comfortable, it suggests that one is knowledgeable about computers and the use thereof.

In an attempt to create synergy of the above concepts, it is imperative to understand the shaping of technology as posited by Blomdahl and Rogala(2008, p.25) below.
The model above is the development of a school-based curriculum whereby teachers and learners negotiate collectively on the working field. The essence of bringing learners is to make them take responsibility for their learning, and once such a situation is created, the teachers will facilitate the learning process. Didactic models stem from two phases namely: projection and production. The first phase is projection, in which the teacher gives assignments to the learners to execute with his or her assistance. The learners will normally work in groups, brainstorm on common ideas and ultimately agree on specific drawings or models. Second is production, in which the actual development of drawings is taking place as well as product design. This however, involves high innovative skills.

2.3 TECHNOLOGY EDUCATION

According to Johnson (1992, p.1), the implementation of Technology Education evolves around the provision of relevant and experiential opportunities for learners to learn better. Technology education is concerned with developing student technological literacy by way of exploring and solving complex and interrelated technological problems that involve multiple conceptual, procedural, societal and technical variables (Jones & Moreland, 2004, p.122). Technology education is regarded as a school subject designed to assist learners to develop technological literacy insights. Technology education is not the same as educational
technology. This however, constitutes instructional technology which essentially involves the study of computers and use of technological advancements such as visual equipment and computers to enhance and optimize the teaching and learning process in the school. Technology is defined as a form of human knowledge aimed at creating artefacts (Pavlova, 2005, p.122).

The progression in technology is characterised by three aspects as identified by Jones and Moreland(2004) namely, “(i) the nature of technology, and (ii) dimensions of student technological practice, which could include the increasing complexity and sophistication of the operationalisation of conceptual procedures” (p.122). In ensuring that teachers are effective in teaching technology education, they need to be well acquainted with knowledge of technology as a concept. In order to be more effective in technology education teaching, it is imperative for educators to develop three dimensions of knowledge as identified by Jones and Moreland (2004, p. 123), namely, knowledge about technology, knowledge in technology and technological pedagogical knowledge. Educators’ understanding of the nature and purpose of the discipline strongly influences their personal pedagogical content knowledge. Importantly, Jones and Moreland (2004) said “A blending of content and pedagogy represents how certain topics are organised for learners for easy understanding” (p.123). Therefore, teaching should begin with a clear understanding of what is to be learned and what is to be taught.

Teachers play a more pivotal role in the students’ learning than any other factors associated with learning. Importantly, students learn best when teachers spend more time focusing on content, with learning activities directed at the learner’s level of comprehension. According to Liu and Szabo (2009, p.6), for students to learn from a passive transfer of information to active learning, the teacher would create situations that students can experience, instead of simply delivering the plain information. In this regard teachers should organise the information to the extent that it will be easily understood by learners.

In addition, Liu and Szabo (2009, p.6) argue that everyone recognizes that teachers play a major role in how successful the use of technology will be in education. Research has shown that teachers have more impact on student learning than any other factor controlled by school systems, for instance class size and the quality of after school interventions such as remedial classes for learners progressing slower than the other learners. This, however, is possible when teachers have a thorough content knowledge. This suggests
that teachers should possess a subject-specific professional knowledge that bridges content knowledge and knowledge about the practice of teaching (Li & Szabo, 2009, p.7). Having all these attributes, the teachers will be able to understand the content to be taught and be able to cite practical examples of the concepts. Since technology is regarded as a manifestation of human creativity; the teachers in the classroom setting should allow learners to engage in technological creation and encourage them to bring uniqueness to how they approach problems (Li & Szabo, 2009, p.7).

Implementing technology education is sometimes a challenge. This is characterised by the following aspects as identified by Moalosi & Molwane (2008, p.33):

a) Lack of teaching material and resources.

b) The syllabus is very detailed, which compels teachers to give summaries of the subject matter.

c) The specific objectives of some modules are difficult to understand.

Disadvantaged schools are faced with challenges of lack of resources as well as qualified educators. According to Chigona, Chigona, Kayango and Kausa (2010, p.21) these challenges reduce the opportunities available for learners to take part in education and training. Since teachers play a major role in the learning process, it is imperative that the following issues as identified by Cajas (2002, p.183) should be considered, since they are important for learners to achieve technological literacy: (i) develop a tool to assess technological literacy, (ii) create research-based curriculum materials, (iii) establish policies that can help state and parents to use standard based resources to improve learners’ understanding of technology ideas and skills and (iv) create the public support for technological literacy.

In order to ensure the success of technology education, the choice of learning material plays an important role. According to Blomdahl and Rogala (2008, p.25), the choice of learning material is the starting point and this should involve stakeholders within and outside the school milieu. In terms of external milieu, places with technical environment with technical systems, production processes should essentially form part of the learning material. In pursuance of this place as part of learning material, the teachers are likely going to provide learners with the chance of becoming familiar with and as such gain a better understanding of various parts of the complicated technical settings (Blomdahl & Rogala, 2008, p.25). The learning material from the local environment also gives rise to thematic work where various
subjects may be integrated in a specific project. By so doing, the level of understanding technological acumen is enhanced.

Blomdahl and Rogala (2008) argue that “Despite the type of material the teacher may opt to use or work with, there are some specific content components which should be fulfilled otherwise the teaching will not be about technology” (p.26). These authors identified the following as critical components for the learning material: (i) Technical information – this involves availability of tools and machines at school of which the learners should have requisite knowledge. Technical information is important for the learners since it will enable them to have insights into technical principles such as mechanism, and electronic systems. It will further assist in interpreting information concerning issues such as product declarations, and dangers associated with certain products. (ii) Knowledge of material – in this regard, the learners should have knowledge of the types of material, their attributes and the manner in which they are joined or simply manufactured.

It is further important to have a thorough understanding of the use of such material to ensure that they are applied effectively. Documentation – in this case teachers should demonstrate the entire learning process from inception up to assessment. The inception per se could involve the formulation of assignment, various forms of visualisation as well as evaluation. (iii) Mastery – it is important to have a thorough mastery of terminologies associated with technology discipline, as well as those that contribute to technology awareness. In the facilitation in different fields of technology, it is imperative for the learners together with the teacher to select products, and production processes that they want to pursue (Blomdahl & Rogala, 2008, p.26).

2.4 UNPACKING THE NOTION OF TEACHING PRACTICES

There are many theories in educational practice. That is, teachers are trained to teach different disciplines differently through theories of teaching and learning. This does not necessarily mean that when these teachers leave college they apply these theories as they were taught to do them. Teaching practices in the context of this study are essentially what teachers do when confronted with the task of enhancing learning of a specific cohort of learners in a particular learning situation. Thus teacher practices will differ from situation to situation and between teachers or their contexts. In other words, teaching practices are a product of teacher knowledge and the context in which they find themselves. Instructional practices are further
guided by teacher actions in situations before them in the classroom. Situational action or activity reflects the individual teacher’s level of professional competence. Thus professional competence will be a determining and important factor in the classroom setting and teaching practices (Talis, 2009).

This study is not only about teachers’ application of theories they learned at college. This cannot be the case, as it was indicated in the background of this study that some of the teachers were not trained in some areas of technology education. The emphasis in this study is looking at every possible act by, and justification thereof, by teachers in their teaching. According to Talis (2009) good teaching practice is about being responsive to learners’ needs of learning. In other words, the practices referred to here are all actions that teachers engage in to enhance learning in different situations of their practice. These actions may not necessarily be effective, but compromises that they consider being helpful at that time. Understanding these actions would thus require multiple theoretical lenses.

2.5 THEORETICAL PERSPECTIVES GUIDING THE STUDY

As indicated in the initial stages of this report, the study is an exploration of technology teachers’ teaching practices. This study is situated or takes place in a changing educational context. It would have been difficult therefore to rely wholly on a particular theoretical underpinning considering the dynamics of a changing social, political, and cultural environments. Practices can mean many things in the context of teaching. They can also mean different things in different teaching and learning contextual situations such as conceptual and procedural knowledge. For the purposes of this study it was imperative that the study is underpinned by perspectives such as pedagogic content knowledge (PCK) to guide the study specifically and in light of the different types of knowledge the teachers bring into the learning situation. In addition, the Kolb model of learning was thrown into the mix to assist in understanding how teachers of technology education engage with promoting their learners’ concrete experiences and working actively with object manipulations (Kolb, 1984).

Finally, combination of the elements of both the teaching competence model and constructivism are used as a way of explaining some of the practices teachers used in carrying out their everyday teaching of technology education. According to the teaching competence model(Cabrera & La Nasa, 2002) the teacher demonstrates his/her competence in handling the teaching context, especially different learners’ characteristics, and the classroom
settings and/or environment. Constructivism (von Glasersfeld, 1996) brings to the fore how teachers ensure construction of understanding of concepts or knowledge.

In the paragraphs that follow the different theories are briefly discussed to illuminate what they are and how they would contribute to our understanding of different practices teachers engage in, in their individual practices of teaching. It must also be added that these teachers practice in different contextual situations.

### 2.5.1 Pedagogic content knowledge

In the context of teaching, it is imperative as a teacher to understand what you are teaching and how you will be teaching the content, and this will essentially enhance the possibility of teachers becoming effective. Pre-service programs and professional development opportunities often focus on developing teachers’ knowledge and skills in understanding students’ technological work and thinking (Hill, 2008, p.373). A technology education teacher with a pedagogical knowledge understands the selected technology concepts to be taught in the study. Furthermore, content knowledge assists the teacher to understand how to teach a particular technology education concept appropriately. The two components, as well as the research questions, assisted the teacher’s framework in explaining the effectiveness of the study. The two components of teachers’ knowledge of instructional strategies are divided into pedagogical knowledge and content knowledge and this can therefore be grouped together as Pedagogical Content Knowledge (PCK) (Hill, 2008, p.373). Hill (2008) said that “Although what we call ‘knowledge of content and students,’ or teachers’ knowledge of students’ mathematical thinking and learning, is widely believed to be an important component of teacher knowledge” (p.373). It is therefore assumed that a teacher who has completed teachers’ qualification should have an understanding of the two components which serve as pillars for effective teaching to take place. Hill (2008) said, although the work is an ongoing process, we chose to write about it at this particular juncture because our efforts might be instructive to others trying to conceptualize, identify, measure, and ultimately improve teachers’ PCK (p.373).

The concept of PCK was first introduced by Shulman (1986, p.8) which refers to teachers’ interpretations and transformations of subject-matter knowledge in the context of facilitating student learning. According to Driel, Verloop and De Vos (1998, p.673) they attest that PCK constitutes an understanding of ordinary learning problems encountered by learners and this
is regarded as a form of practical knowledge that is used by teachers to guide actions in a highly contextualised classroom environment. Rowan, Schilling, Ball & Miller (2001, p.3) argue that practical knowledge as posited by Shulman (1986) is concerned with (i) knowledge of how to structure and represent academic content for direct teaching of learners; (ii) knowledge of the common conceptions, misconceptions and difficulties learners experience in the process of learning a particular content and (iii) knowledge of the teaching strategies that teachers may apply to address learning needs in a particular classroom setting or circumstances. For teachers to be more effective, this practical knowledge should be building blocks in the professional knowledge and skills.

The development of PCK is regarded as an integrative process revolving in the context of interpretation of subject matter knowledge by teachers. Wiliams(2012, p.35) indicates that there are three factors that contribute to the growth of PCK namely, (i) good subject matter: this is important for teachers to have a sound knowledge of the subject matter in order to disseminates that successfully to the learners. Lack of knowledge may hamper effective learning as a result of lack of self-efficacy and could affect the performance of the learners drastically. (ii) Classroom experience: the experience as teacher also plays an important role in the process of teaching. With relevant class room experience, the teacher is able to deal with class room management effectively and would be able to give practical life experiences emanating from his/her previous class settings. In the case where teachers are without prior teaching experience on the subject matter knowledge, they may however lack confidence in facilitating teaching. (iii) Possession of emotional attributes such as self-confidence: if teachers possess self-confidence for the subject that he or she is offering, there is a great possibility for that teacher to disseminate the subject matter successfully.

In order to develop a sound PCK, it is imperative to take the following factors into account: (1) The role of subject matter knowledge - various scholars have posited that pre-service(inexperienced) teachers’ content knowledge is often limited and this could lead to misconceptions which would subsequently lead to lack of confidence. Therefore, subject knowledge should be immanent for teachers to succeed in their teaching practices (Driel& Berry, 2010,p.658). Due to lack of suitably qualified teachers in the new subjects, teachers are being trained through in-service so that they are able to teach the subject. This type of training is aimed at providing teachers with insight on what teachers must know and understand, the best way to comprehend and best methodologies to teach content to their respective learners.
(2) Teaching experience - teaching experience is regarded as the prerequisite to teach a particular content (Driel & Berry, 2010, p.658). Lack of experience suggests that such teachers have little or no PCK and the concern facing inexperienced teachers is whether they would have self-efficacy on teaching the content as allocated. Driel and Berry (2010, p.658) argue that until teachers have acquired sufficient confidence, experience and basic classroom skills, that could derail the translation of subject matter content in the classroom.

(3) A focus on learners learning - when preparing instructional strategy, it important to understand different ways in which learners learn specific content and in this context, prior knowledge of learners to instruction should be considered.

In conceptualising PCK, it is important to understand the pedagogical knowledge in conjunction with the set of teachers’ knowledge as identified by Shulman (1986, p.12). This analogy is presented in figure 2.2 depicted below.

![Figure 2.2: Categories contributing to PCK](Image)

**Source: Adapted from Newsome & Lederman (1999)**

According to Newsome and Lederman (1999, p.21) knowledge of educational ends and purpose cannot be separated from knowledge about evaluation and assessment procedures. All these aspects are intertwined to create a synergy of processes in the assessment of learning activities. Furthermore it is evident that curriculum knowledge gets inputs from
content knowledge and knowledge of goals as well as assessment procedures. Notably, pedagogical knowledge receives inputs from knowledge of learners/learning as well as knowledge of goals/assessment procedures.

The other important aspects of the above model are the knowledge of general educational contexts which of course teachers should be acquainted with. This however can further be classified into specific knowledge contexts which can constitute knowledge of specific content, specific curriculum, and specific pedagogy, and so on. In the analysis of this model of PCK, in order for teachers to be more effective, they need to develop their knowledge on the premise of the aspects as embedded in the model as well as the sound development of their PCK (Newsome & Lederman, 1999, p.21).

2.5.2 The Kolb model of learning

In this section a number of theories will be discussed. The aim of the study was to investigate the teaching practices of teachers in offering technology education in schools and to determine how these teaching practices are developed to enhance learning of selected concepts within particular topics. This model of learning gives a detailed account of theory of the subject under investigation. For teachers to be effective in their teaching strategies, it is imperative for them to understand content knowledge and teaching practices. In this instance, content knowledge refers to the knowledge about the subject matter that is to be learned or taught (Harris, Mishra & Koehler, 2009, p.397). Content knowledge alone is not enough, pedagogical knowledge becomes imperative which according to Harris et al. (2009, p.397) is deep knowledge about the processes and practices of teaching and learning, including educational purposes, values and strategies. This further encompasses knowledge about the teaching methodologies used in the classroom settings. Importantly, a teacher with a deeper pedagogical knowledge understands how learners construct knowledge and acquire skills in differentiated manners. As such, pedagogical knowledge requires an understanding of cognitive, social and developmental theories of learning and how they apply in the classroom setting (Harris, et al., 2009, p.397). For the purpose of this study, the framework of Grossman (1990) will be followed which defines Pedagogical Content Knowledge (PCK) as one’s knowledge of how to teach a particular subject content in a specific context. Grossman (1990) posits the framework in four dimensions: (i) the first dimension relates to the teacher’s knowledge about the purpose of teaching which is reflected in teachers’ goals. It is important for teachers to have knowledge and this will ensure that teachers become more effective in
their teaching. Having thorough knowledge on the subject matter is crucial, since that will develop self-confidence among teachers and as such their teaching practices will be enhanced. (ii) Second, is the dimension that incorporates the teacher’s knowledge of the students’ understanding of the subject matter. In this regard, teachers should be aware of what a student already knows, as well as having knowledge of the subject matter that is likely to be challenging and need further development. This dimension is imperative for teachers when presenting lessons in the sense that it enables teachers to be more considerate to learners’ previous knowledge. By so doing, teachers will always tap into learners by way of questions to understand the level of their understanding. This dimension compels teachers to be more learner-centred which is regarded as better way of enabling learners to learn best. This notion emanates from the fact that students’ outcomes such as learning occur in a setting shaped by students. (iii) Third, is the dimension that refers to the teacher’s knowledge of instructional strategies or methodologies for teaching specific topics. Though teachers were trained in particular methodologies, most of them are out-dated, therefore they need to adopt and apply current methodological strategies that are more current, hence this study is focusing on the teaching practices to understand how teachers are teaching technology education based on the current curriculum. (iv) Fourth, is the dimension that relates to teachers’ knowledge about the curriculum content as well as knowledge of the specific content required for a given cohort. This dimension is important because being knowledgeable on the curriculum will assist the teacher in presenting the subject matter much better. The study will be grounded on this model. The four dimensions are imperative in ensuring viable teaching practices in South African schools. The teachers’ practices will therefore be reflected in the four dimensions as described by Grossman (1990).

Kolb (1984, p.20) attests that individual experience is learning on the basis of concrete experiences, conceptualizing of experiences, working with ideas or concepts or actively experimenting with or manipulating objects. Kolb (1984, p.30) organised cognitive styles under two domains namely, (a) the concrete-reflective domain and (b) abstract-active experimentation. The two domains are depicted in table 2.1 and the components of each domain are summarised.
Table 2.1: Components of domains

<table>
<thead>
<tr>
<th>CONCRETE –REFLECTIVE DOMAIN</th>
<th>ABSTRACT – ACTIVE DOMAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Experience</td>
<td>Reflective Observation</td>
</tr>
<tr>
<td>Affective:</td>
<td>Perceptual</td>
</tr>
<tr>
<td>Being sensitive to the values.</td>
<td>Organising information.</td>
</tr>
<tr>
<td>Being sensitive to people’s feelings.</td>
<td>Listening with open mind.</td>
</tr>
<tr>
<td></td>
<td>Developing comprehensive plans.</td>
</tr>
<tr>
<td></td>
<td>Imagining implications for ambiguous situations.</td>
</tr>
</tbody>
</table>

Source: Adapted from Kolb (1984)

As indicated above, the learning cycle consists of four elements, namely concrete experience, reflective observation, abstract conceptualisation and active experimentation. These elements as depicted above are discussed in details thereafter.

The model above consists of four different stages of learning from experience and the rest of the stages should be followed in sequence for successful learning to take place, and these stages are discussed in the preceding section. The stages create synergy which is necessary to reflect on the experience to make generalizations and formulate concepts which can be applied to new situations (Kolb, 1984, p.31).

The concrete experience starts the learning cycle and it unfreezes learners from their held perspectives (Kolb, 1984 p.31). This however, relates to the experience of having to perform certain learning activities that could be learned through being a learner and it is able to stimulate learning. According to Kolb (1984, p.31) concrete learning is able to contribute to learners’ motivation to learn; it provides a common reference to integrate and reconcile diverse experiences of learners. In order for this notion to be real, the educators should have a
wide experience of imparting knowledge to the learners, and this would be imperative to relate new learning information to the past experiences. In the context of having concrete experience, teachers should understand that it sets the stage for the learners’ learning by engaging them on an affective level. Concrete experience assists learners to connect to the past and anticipate the future.

**Reflective Observation**

In this instance, the learners address learning objectives from observation instead of an action. Kolb (1984) says, “This element originates from the analysis and judgment of events and teaching practices that one engages in with the learners. In the normal day to day life, people usually reflect on their experiences of teaching, especially when they are new to the situation and are less confident in their abilities”, (p.32). The discussion on reflective experience plays a crucial role in learning from each other particularly among inexperienced or pre-service teachers. Such teachers could however use what they have learned from their peers to disseminate information in such a way that learners are able to evaluate, to see possible implications and think broadly about the meaning of things. As a teacher it important to do self-reflection after an event or class session through for instance a logbook to record occurrences, use peer evaluation and get student feedback, which will give an overall reflection on your own teaching practices. In the end, these would give an indication of whether one is on the correct route or not. From this notion, corrective measures could be implemented to ensure that similar flaws do not recur and it could also assist the teacher in improving the teaching practices. Reflection plays a crucial role in the development of teachers’ insight into ways to teach better, for example, one may have twenty five years of experience which may consist of teaching the same content the same way. In this instance, unless there is a reflection about teaching and the views of others such as peer teachers, moderators and learners, no professional development will take place.

In the final analysis, reflective practice is imperative in the sense that it contributes towards the development of teachers and it enables them to learn from experiences of teaching and facilitating learners’ learning process. Importantly, reflective practice means developing ways of reviewing teaching practices so that it becomes a routine and a process by which teachers should develop in order to be effective teachers.
**Abstract Conceptualization**

According to Kolb (1984, p. 32), with abstract conceptualisation, learners usually develop and act on intellectual understanding of the situation and from their understanding they are able to create concepts and theories from their own observations. For learners to be creative, the teaching strategy should be interactive (Kolb, 1984, p.32). This means that the teacher should serve as a facilitator and allow learners to engage and come up with their own solutions or suggestions in the context of what they are learning. In order to promote abstract conceptualisation, there is a need to do things differently; for instance, the teachers should be versed with educational theories and attend staff development interventions. By so doing, teachers are likely to draw conclusions about their practices.

**Active Experimentation**

This element is all about actual execution of activities within a learning environment (Kolb, 1984, p.34). In this case, learners in conjunction with the teachers come up with ways to solve real life problems and make decisions. According to Kolb (1984, p.34) experimentation focuses more on learning by doing, which encourages active participation and creativity by learners. With experimentation, the learners approach learning objectives by influencing people and events through actions. They further attempt to apply new knowledge in another environment.

**2.5.3 The teaching competence model**

According to Cabrera and La Nasa(2002, p.4),students’ outcomes such as learning take place in a context shaped by students’ own characteristics, the instructional practices they experience in the classroom settings and the classroom climate created by teachers. This model is depicted in figure 2.4 below.
From the figure above, it is evident that teaching competence can be categorised into four phases. The first phase relates to teaching practices. This phase however depends mainly on the instructor interaction with the learners and the feedback provided. The instructional practices in the classroom have influence in the learning process and therefore the teacher’s competence becomes imperative. This suggests that teachers should be well versed and conversant with the teaching strategies. The second phase deals with the student outcomes. The third phase relates to classroom climate. This phase is dependent on the nature of the school and whether it is an environment conducive to learning. The fourth phase is concerned with the students’ characteristics. Among factors that affect students’ learning is learners’ own intellectual ability. In the context of this, learning is guided by the degree of intellectuality that the learners possess. The higher the degree of intellect, the easier the student will comprehend. The other factor that relates to students’ characteristics is educational aspirations, which are normally stimulated by role models and the educational level attained by their parents. In this case, parents would encourage their children to study
more, in order to emulate them in one way or the other. Furthermore, learning styles of the students are influenced by gender.

2.5.4 Constructivism

According to Van Wykand Alexander(2010, p.161), constructivism implies that learners are encouraged to construct their own knowledge in real life situations with others, instead of in formal situations where they actually work on their own. In this regard, learners build new knowledge on the basis of their previous learning experience. More importantly, constructivist pedagogy is required to develop learning through the promotion of the virtues of the individual’s search for meaning and the knowledge acquired based on that particular search. Boser(1993) attests that “Pre-service technology education teachers should participate in order to acquire the skills needed to be competent technological problem solvers and to use problem solving effectively as an instructional methodology” (p.14).

In the context of this, teaching methodologies are vital and as such the creation of knowledge from experience and the use thereof to support new learning processes constitute a fundamental principle of constructivism. This theory becomes important for the teachers to understand in order for them to be able to implement the teaching practices effectively. In the end, constructivist beliefs are articulated as: (i) The teacher’s role is to facilitate the learners’ own inquiry. This aspect suggests that teachers should serve as facilitators in the learning process and should allow learners to learn and initiate learning process to take place. By so doing, this model will enable the teachers to be more effective in their teaching practices, considering the fact that learners learn best when they are allowed to initiate their learning. This is further in line with the new learning principles, particularly with the new curriculum. (ii) Learners learn best if they find solutions on their own. It is a well-known notion that with modern learning processes those learners should be afforded the opportunity to find solutions on their own. Ordinarily, this is more prevalent with the project-based learning whereby learners will be given some assignments and should essentially come up with solutions or answers. (iii) Learners should be afforded the opportunity to seek solutions before the teacher shows them the way to solve such problems and (iv) Learners should be given a chance to think independently, which is more imperative than specific curriculum content. In the process of this, it is believed that teachers regard learners as active participants in the learning process of gaining knowledge, compared to where the teacher’s roles is seen as that of dissemination of information to the learners (Talis, 2009, p.90). To achieve this,
teachers should put emphasis on ensuring that learning is well constructed, which calls for a thorough preparation for a learner-centred approach which give learners autonomy to learn on their own and at their own pace. Using this model could improve teaching practices and as such learners would fare much better, compared to the conventional way of teaching where the teaching strategy is more teacher-centred.

Chigona et al. (2010) confirmed that “The use of technology allows a more efficient way to develop aspects of learners’ thinking than would be achieved when employing traditional teaching practices” (p. 22). This means that the reasoning capacity, understanding and creativity of learners are increased. This approach [constructivism] promotes higher order thinking and better problem-solving strategies (Chigona et al., 2010, p. 22). This approach allows educators to focus on critical activities such as lesson planning and other relevant activities.

2.6 SUMMARY

In this chapter a discussion was made of the literature pertaining to technology education and related concepts. This however, applies to technology which has become a compulsory subject in the schools. This has essentially replaced the conventional way of teaching and attempts to develop learners to work in groups. Further there was a discussion of the technology literacy which relates to one’s ability to use, manage and understand technology in full. Once there is a full understanding of what technology literacy is all about, learners would be comfortable using technology.

There was also a discussion of technology education which is regarded as an instructional technology which involves the study of computers with a view to optimising the teaching and learning process. Teachers in this regard are essential to facilitate the learning process and give learners the liberty to be creative, solve problems and make decisions on what they foresee as feasible. In the discussion, it was notable that there are challenges in the teaching of technology education characterised by the lack of teaching material and resources, as well as a detailed syllabus, which forces teachers to provide brief of the subject matter instead of giving details.

Pedagogic content knowledge was discussed in detail. This involves defining it as a concept which relates to teachers’ interpretations and transformations of subject matter knowledge in
the context of facilitating student learning. A further discussion followed on the categories contributing to PCK.

The theoretical framework (Kolb, 1984) relating to the learning process was outlined in detail, which covered concrete experience, reflective observation, abstract conceptualisation and active experimentation. Constructivism as a theoretical model was also discussed, which involves encouraging learners to construct their own knowledge in real life situations with others, instead of formal situations where they actually work on their own.

In the next chapter, a detailed discussion of the research methodology will follow. This will entail the research design, and methodology followed during data collection. A further discussion will be undertaken on the sample description and technique used to select the participants and how ethical issues were addressed.
CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

3 INTRODUCTION

This chapter describes the research design and methodology employed in the study. It further articulates how the research process was followed at the selected site to investigate teachers’ teaching practices in the sampled schools. A detailed methodology will be outlined with the view of unfolding the process inter alia with design, population and sampling, data collection process and techniques, data analysis, a mechanism followed to ensure that trustworthiness is ensured and finally how ethical considerations were addressed in the study.

3.1 CONTEXT OF THE STUDY

The research was conducted in Nokaneng and Mmametlhake circuits of the Mpumalanga Department of Basic Education. Mmametlhake and Nokaneng are circuits within the Nkangala district of Mpumalanga. The three schools are situated in the broader J.S. Moroka Municipality of Moretele East. As earlier indicated, the focus of the study was on the teaching of technology education. The teachers were expected to teach technology with limited knowledge and skills in technology education teaching.

3.2 RESEARCH METHODOLOGY

In this section, research design, population and sampling, data collection and data analysis are discussed.

3.2.1 Research Design

The design of this study is qualitative and explorative in nature. A qualitative approach offers the opportunity to uncover the nature of the methodologies applied by educators in teaching technology education, and their experiences (Creswell, 2009, p.62). Qualitative research seeks to discover and describe in narrative reporting what the researcher did in the respective activities. In most cases qualitative research involves the analysis of textual data. The researcher intended to gain a deeper understanding of a specific situation during the teachers’ teaching processes in grade 9 classes. As individual teachers do things differently, the
The researcher adopted a multi-case study approach in order to gain in-depth understanding of the teachers’ strategies and the methods they used to teach the subject under investigation.

### 3.2.2 Population and sampling

The population for the study consisted of individual teachers teaching technology in grade 9 classes at different schools. The three cases focused in this study were sampled from the thirty participants who took part in answering the questionnaires from the workshop. The workshop was conducted in Marapyane circuit at Kgamane High School. Marapyane circuit is one of the circuits within Nkangala district. All teachers gathered at the workshop were from Mmamatlhake, Nokaneng and Marapyane circuits which forms part of Nkangala district. The researcher selected the three teachers from different schools purposively. In using purposive sampling, the researcher was of the opinion that they would provide the relevant responses since they were teaching the subject and they were selected on the basis of their experience in teaching the subject. De Vos, Strydom, Fouché and Delport (2011, p.232) attest that this sampling technique is based entirely on the judgement of the researcher, in the sense that a sample is composed of elements that contain the most characteristic typical attributes of the population that serve the purpose of the study. White (2005, p. 120) argued that purposive sampling is based mainly on the judgement of the researcher, in the sense that the sample consists of elements that contain the most characteristic, typical attributes of the population.

According to the researcher, purposive means a sampling in a deliberate way, with a purpose in mind and the fact that participants have information about the topic of interest. In this case, the researcher used her knowledge of the selected population and made a judgement as to who should be selected to provide information to address the purpose of the research. According to Polit and Beck (2008, p.339), sampling refers to the process of selecting a portion of the population so that inferences about the population can be made. The criteria for selecting participants were based on the fact that they were teaching technology in their respective schools in grade 9 classes. They have thorough knowledge of the subject matter hence they furthered their studies to gain more knowledge of the subject. The researcher selected participants according to their teaching experience. The researcher’s main focus was to explore the teachers’ teaching practices in each case.
3.2.3 Delimitation of the study

Technology was first introduced as a subject in 1998. All teachers who attended the content enrichment workshop at Kgamane High School have been in their teaching field prior the implementation of technology as a subject. The three teachers have more than 20 years of experience in the teaching field. In the context of developing the country with shortage of adequately qualified teachers, it is vital to provide teachers with as many guidelines as possible (Engelbrecht et al., 2007, p.11). They were sampled because two of them furthered their studies to get the pedagogical knowledge of the subject matter.

According to Engelbrecht et al. (2007, p. 586) teachers have not been given sufficient continuing professional teacher development through the cascade effort of the DoE to help them cope with OBE in general and specifically with technology. From questionnaires in section 2 under the intervention provided to teachers, the researcher justified the teachers’ experience by reading data from the first question of this section. It was depicted that 80% of technology teachers who attended the workshop were not formally trained in this special field. The remaining 20% went further with their studies hence the sample of teachers with more than 20 years of experience.

3.2.4 Ethical consideration

The respondents, who participated in this research, were all made aware of the purpose of the study. They were also given the freedom to stay anonymous, insight into the final draft of the research and to stop participation at any time as well as the right to confidentiality.

3.2.5 Data Collection

The researcher conducted semi-structured interviews with the three selected participants from their respective schools, namely each teacher was taken as a case. The reason for choosing three teachers was to enable the researcher to gather various views on the teaching practices and explore how they implement their teaching strategies. Questionnaire was the other instrument that was used to compliment the three participants for data gathering. Questionnaires were distributed among the 30 participants who attended a technology workshop for content enrichment. This approach was regarded as appropriate because it enables the researcher to probe responses and observe other occurrences. Furthermore, Noor (2008, p.1608) argued that this method allows for sufficient flexibility to
approach different participants while covering the areas of data collections. Wright (2007, p.28) argues that interviews should be used as data gathering method, where it is imperative to develop an interview guide or type. A prototype for the interview was developed in consultation with the supervisor, who is experienced in conducting interviews and is familiar with PCK. This method was appropriate because it affords the researcher opportunity to explore the subject under investigation to get in-depth data from the participants and the participants are at liberty to give more experiences during the semi-structured interviews. The researcher contacted the educators to determine their willingness to take part in the study. After consent was obtained, the researcher contacted the participants to make appointments for observations and semi-structured interviews and also introduced herself. Prior to semi-structured interviews, the researcher sent the prototype to the participants so they could familiarise themselves with the type of questions to be posed. During the research process, the researcher started by observing the teachers’ teaching practices in the classrooms. The observations lasted for only 30 minutes. The observation was important for the purpose of seeing what was happening in the classroom settings. After the lesson, the researcher started with the semi-structured interview.

The researcher wrote field-notes that will be used to analyse data. The semi-structured interviews occurred in the staff rooms of the visited schools. Each interview lasted for the duration of an hour. The researcher took field notes regarding teaching practices and also used a digital voice recorder to record teachers’ verbalisations of the entire interviews. Furthermore, observations were used to triangulate data sources. The participants were purposively selected amongst other teachers teaching technology education, since the researcher was of the view that they would provide the information relating to technology practices. All the interviews were transcribed by the researcher.

All the participants were briefed prior to observations and interviews on the purpose of the interview and the interview process. The prospective participants were given the opportunity to read the informed consent and thereafter they gave acceptance to participate in the study. Furthermore, they were told that the study was voluntary and if they agreed to take part. They were also given liberty to withdraw from the interview if they felt uncomfortable to take part in the research process.
3.2.6 Data gathering instruments

The data gathering instruments used in the research study included direct observation, interviews and open ended questionnaire as data collection techniques. The researcher aimed to triangulate the findings by using the above mentioned data collection instruments applied in the study in order to facilitate verification and validation of the findings. According to Cohen et al. (2011: 195) triangulation is the use of two or more methods of data collection in the study of some aspects of human behaviour. Triangulation enabled the researcher in this study to produce more complete and well validated conclusion.

Direct observation

The direct observation method was directed at how grade 9 teachers in their natural classroom setting teach a particular technology education concept. The researcher decided on direct observation as one of the data gathering method due to the fact that certain information can be obtained through direct examination by the researcher. Three respondents were involved in this observation process. The idea was also to observe any constraints present that hinder the teacher in performing his/her task in the classroom. Observation involves the systematic viewing of people’s actions and the recording, analysis and interpretation of their behaviour (Gray, 2009:397). The researcher used the checklist as recording method. The researcher engaged the observational process by sitting at the back of the class to minimize eyecontact with learners and coding down what was deemed necessary.

Respondents were contacted and timeframe for observational sessions were individually agreed upon. The procedure for collecting data was conducted by using checklists, which focused on the interaction between the teacher and the learners, as well as teaching methods used as to comply with the objectives of teaching practices and the context of the classroom in terms of resources. The observations were recorded on observation tool and as field notes, which consisted of detailed descriptions of events written shortly after the researcher left the field (De Vos et al, 2011: 316). Accordingly, field notes give an account of what happened, providing little or no interpretation. Field notes should contain a chronological description in categories of what happened to the settings and the participants (Grinnell & Unrau, 2008:232). The strength of the direct observation method can be viewed as the fact that it covered events in real time as well as the context of events. The observation tool is shown in Annexure E.

Individual Interview
The interview is in the oral type of questionnaire. Instead of writing the response, the respondents or interviewee gives the needed information verbally in face to face relationship (DePoy & Gilson, 2008:108). As a research method however, the interview can be viewed as more than an exchange of small talk. It represents a direct attempt by the researcher to obtain reliable and valid measures in the form of verbal responses from one or more respondents.

In-depth interview is one on one interview between the researcher and the research respondent (DePloy & Gilson, 2008:149). The researcher used one of the interviews to capture information and to gain insight into resources and practices that could help to understand the teaching practices on technology concepts. The respondents were given time to read and understand the content of a letter of informed concerned indicating their voluntary participation and knowledge of their rights. Three (3) respondents were involved in this interview process. The informed concerned letter is attached in Annexure A.

The researcher employed the interview as a data gathering method due to the following advantages in possesses. The interview is highly flexible and is applicable to different types of problems; it is flexible in the sense that the interviewer may change the mode of the question if the occasion demands. It allows the researcher to rephrase his/her questions in order to obtain clear answers, which are free from ambiguity. In terms of the respondent, he/she can ask for clarification or further information concerning the question. The interview also allowed the researcher to observe the respondent’s reactions to questions posed as well as the way in which they gave answers to the questions. Finally the researcher also had the freedom to set a non-threatening atmosphere to allow the respondents to feel more relaxed towards the interviewer and the process. However the researcher has to admit that this was not always the case with some of the respondents interviewed during the research.

Being aware of how busy the teachers were in the last quarter of the academic year, the researcher contacted each school individually and together decided on a time-frame which suited both the researcher and respondents. Difficulties were also present during the interviews that were held. One of the respondents was at time reluctant to render an interview at work due to work overload. At first the respondent was very tense in the reaction to the questions, but as the interview progressed the respondent became more relaxed and started reacting more positively towards the interviewing process. Interviews were conducted between July and October 2012 which lasted between 40-50 minutes. One of the interviews was conducted at home others at school.
The interview was guided by open-ended questions so as to allow some flexibility and divergence. The interviewer encouraged interviewees to speak freely, demonstrating trust and empathy, while also controlling the process (Heining, van Rensburg & Smith, 2008: 50). At times the researcher had to substantiate on the questions. At other times the questions had to be repeated. A type recorder was used to record the interview and permission was requested before beginning to record. According to White (2005:147), the researcher must request permission to record the participant’s response. Notes were also made while the respondents were responding to the questions. The researcher also tried to maintain eye contact with all respondents constantly and attentively. A written record of what was said was composed for the purposes of data analysis. Interview questions are shown in Annexure G.

**Questionnaire**

A questionnaire was the second data gathering tool used in the research. The questionnaires were drawn up using open-ended questions. The aim was to give the respondents freedom to express and interpret the questions to the best of their ability. The choice of the open ended questions is that the open-ended of unrestricted type of questionnaires calls for a free response in the respondents’ own words. The questions were in line with the context in which grade 9 teachers found themselves.

Furthermore a questionnaire was used as a method of eliciting and collecting data in this research study. Questionnaires are made up of items, to which the user supplies answers, or reactions (Denscombe, 2003:30). The researcher personally distributed the questionnaires to the 30 respondents in enrichment workshop so as to make sure that each one received a copy of the questionnaires and monitored their completion. Each respondent received the same set of questions phrased in exactly the same way. As in the delivery process, the questionnaires were collected personally from each respondent.

The main question that was asked was what are teachers’ teaching practices when teaching technology concepts? The main reason for choosing a questionnaire was that it contains the same questions for all subjects and can ensure anonymity (McMillan & Schumacher, 2010: 195). The researcher employed the questionnaire as a data gathering tool because the cost and time involved in using questionnaires is less than with interviews. The questionnaires were posed to 30 respondents. Most of respondents completed the questionnaires in full while others left the column on comments not responded to. Where respondents had difficulty
interpreting questions, the researcher was in reach and could clarify any problems such as misinterpretations.

The questionnaires assisted the researcher in the process of identifying respondents for sampling purposes. Respondents were sampled according to how they responded to the questionnaires. The questionnaire contained the purpose of the study and was divided into 3 sections. Section 1 covered the bibliographic information. Section 2 focused on interventions provided to respondents covering the teachers’ understanding of technology concepts. Section 3 also focused on statements relating to teaching practices in the classroom. The questionnaire is attached as Annexure F.

3.2.7 Data analysis

Data analyses involved reducing data into manageable elements after collection. The collected data were transcribed and content analysed according to themes and categories and then coded. This was done by looking for the main ideas, which will then be put into categories. The commonly used categorising strategy in qualitative data analysis is coding as indicated by (Maxwell: 2012, p.64). The researcher used this process and was guided by six steps of approach to data analysis as identified by Creswell (2009:186) that consist of (i) transcribing the interviews, (ii) reading through all the data, (iii) coding data, (iv) generating themes, (v) advancing how themes will be represented in the qualitative narratives and (vi) interpreting the meaning of the data. In this regard, data from the three interviews were transcribed and from there, they were carefully read to make a sense as well as data from questionnaires. The researcher wrote the essence of the idea and categorised them into themes. These processes included data interpretation and verbatim narrations which were converged into the report writing. The following questionnaire tables are the responses from the 30 participants.
3.3 VALIDITY, RELIABILITY AND MEASUREMENT TO ENSURE TRUSTWORTHINESS

3.3.1 Validity

The validity is an instrument thus refers to the extent to which it measures what it is supposed to measure (Cresswell, 2007: 216). Before conducting this research study, the researcher ensured that she produced convincing and consistent findings by having the questionnaire assessed by the supervisor. The supervisor went through the questionnaire and was recommended before the actual research could take place.

3.3.2 Reliability

Reliability is premised on the notion that there is some sense of uniformity or standardization in what is being measured, and that methods needs to consistently capture what is being explored. According to Creswell (2007:215), reliability is the extent to which a measuring instrument is repeatable and consistent. Reliability is therefore the extent to which a measure produces, or an instrument provides the same results on repeated trials (O’Leary, 2004:59).

3.3.3 Trustworthiness

To ensure that trustworthiness was achieved, aspects (i.e. credibility, transferability, dependability and conformability) of the framework of Lincoln & Guba (1985, p.315-318) were used. In addition a pilot study was conducted to ensure that some of the data collection instruments were consistent with the data they were used to collect. That is, trustworthiness was achieved through prolonged engagement with participants, triangulation of the data, purposive sampling, peer debriefing, and authority of the researcher and the use of an independent coder (Creswell, 2009, p.191; Babbie & Mouton, 2008, p.156).

3.3.4 Pilot study

A pilot study was conducted to gain insight on the possible shortfalls on the instruments used. As part of pilot study, the structured questionnaire was given to one teacher who is teaching technology education with the view of assessing the level of understanding the questions. No major challenges were found with the manner in which the questions were answered therefore there was no need to amend the questionnaire and interview schedule.
3.3.5 Credibility

In ensuring credibility, the researcher followed the following activities: (i) focused on persistent observation – the researcher observed any attributes that could impinge the credibility of the findings and such observable attributes could be taken into account when data analysis is done; (ii) triangulation – in this case the researcher used different modes of obtaining data characterised by observation of what the teachers were doing in the class that lasted for 30 minutes and (iii) for this research study, the use of interview transcripts, observation field notes and questionnaires lead to trustworthiness. According to Denzil and Lincoln (2003, p.188) it was attested that triangulation offers guidelines, which encourage the researcher to strive for depth and richness in their research. The researcher first addressed personal distortions by introducing herself and the purpose of the study to the participants and this type of clarification; there is a possibility that participants may distort information. By prolonged engagement, the researcher intended to build trust with the participants and therefore they became more open to provide answers in the interviews that lasted for an hour.

3.3.6 Dependability

According to Lincoln and Guba (1985, p.316) dependability could be ensured by way of replication and as such other people should rely on the results produced. In this case, the process focused on fiscal audit by an independent person to verify the process followed. The researcher has kept the field notes, audio recordings and the transcripts. The supervisor has requested the transcripts as a mechanism to verify the data collected and what has been reported. Furthermore, the researcher has requested an independent person to authenticate how data was collected and transcribed and the themes generated in the analyses.

3.3.7 Conformability

In this case, conformability relates to a process whereby an auditor verifies the correctness of the process followed to gather data. To enable this to take place, the researcher used triangulation methods such as field notes, observation, audio recording questionnaires and also kept a reflective diary. All these sources need to be in place to allow an audit trail to take place and in this regard, the researcher has kept all the field notes, audio tape records and the transcripts.
3.4ETHICAL CONSIDERATION

Prior to data collection, the researcher applied for permission to conduct the study in the selected circuit. The Nkangala district granted the approval for the study. The researcher ensured that all efforts were made to ensure that the study was conducted on ethical principles. The researcher conducted the interviews with teachers teaching the subjects in a respected manner and with no harm. According to Punch (2005, p.276) ethical issues are likely to arise in a qualitative approach and this however could be as a result of social intrusion, and sensitivity about the innermost matters of people's lives and as such ethical issues inevitably accompany the collection of such information. To ensure that all key issues were adhered to, the researcher ensured that the following principles of ethical consideration were adhered to. Firstly, the participants were informed that participation in the study was voluntary and if they were willing to participate, and that if they felt uncomfortable during the interview, they were free to withdraw. None of the participants withdrew from the study. Secondly, anonymity was ensured since no personal identifiers were used in the study. Above all, the participants were given a consent letter to read and if they were content with the study, they gave permission to proceed with the interviews and as such there was no need to sign the informed consent due to the anonymity principle.

3.5SUMMARY

The purpose of this chapter was to explain the research demarcation, research methodology, trustworthiness as well as the ethical consideration followed in dealing with issues such as institutional permission, informed consent and thorough explanation of the purpose of the study and rights of the participants. In the next chapter, a discussion will follow on the sample realisation, the technique used to analyse data for the study, and the results presented in terms of themes that emerged, with a detailed discussion thereof.
CHAPTER 4
DATA PROCESSING AND MANAGEMENT

4INTRODUCTION

In this chapter, data collected is presented and processed with the aim of answering the study’s research questions. The important aspect of data presentation and processing is ensuring that there is evidence of both the data and processes that will lead to the findings about teachers’ practices in the teaching of technology. Practices in this study would reflect what teachers do in their teaching. This would also reflect on their knowledge in teaching the topic selected for the study. What teachers understand and how they use their understanding was processed to reflect what was required by research questions. Themes for analysis were therefore constructed using the research questions and related theoretical underpinnings for the study.

Main research question

What are grade 9 teachers’ teaching practices regarding selected technology education topics?

It is apparent that in order to answer this question a combination of methods and processes were required. That is, this question requires information gathered from different sources to be synthesised to arrive at the answer. Thus two sub-questions are used to answer this question.

Sub-questions

• What are grade 9 teachers’ understandings and use of concepts in teaching technology education?

The constructivist view of learning is based on the notion that concepts are building blocks of knowledge. It is on this basis that this question was posed, to understand teachers’ basis of teaching concepts that are related to technology education.
• How do grade 9 teachers teach particular concepts in technology education?

In any knowledge type, there are different concepts with different meanings. In the same vein, teachers have different understandings of the same concepts. Therefore teachers may not use these concepts in the same way, resulting in different approaches to teaching the same thing. In this question the aim was to establish the different ways in which teachers use concepts in their teaching. In addition, teachers do things differently as a result of the context in which they happen to teach the same concepts.

4.1 DATA PRESENTATION AND PROCESSING

In processing and eventually analysing different aspects of data, different steps were followed. Polit and Beck (2012) describe data analysis as “the process of organizing and providing a structure to the data collected in order to make it meaningful” (p. 556). This process differs from one study to the other. In this study, data was condensed into coded themes and categories. Through these themes and categories a network of related texts and statements was used as evidence of teachers’ understandings and use of concepts in their teaching practices. The data used was transcribed verbatim from field notes, audio interviews as well as questionnaires completed by the thirty informants (technology teachers) for the study.

Table 4.1: Informants’ bibliographical information

<table>
<thead>
<tr>
<th>Description</th>
<th>Gender</th>
<th>Age</th>
<th>Teaching experience (in years)</th>
<th>Academic qualifications</th>
<th>Professional qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1: Mrs. Morula *</td>
<td>Female</td>
<td>46</td>
<td>22</td>
<td>B Ed (Hons)</td>
<td>Biology</td>
</tr>
<tr>
<td>Case 2: Mr. Phepeng *</td>
<td>Male</td>
<td>47</td>
<td>25</td>
<td>ACE (diploma)</td>
<td>Biology</td>
</tr>
<tr>
<td>Case 3: Mrs. Nku *</td>
<td>Female</td>
<td>43</td>
<td>20</td>
<td>Diploma</td>
<td>Physical Science</td>
</tr>
</tbody>
</table>

*pseudo names

Table 4.1 represents teachers’ biographical data. This data is presented as part of factors that contribute to teachers’ contextual differences. For example, teaching experience contributes significantly to every teacher’s professional competence and subsequently to the teacher’s daily teaching practices.
4.1.1 Codes and coding of information

Gibbs (2002) describes coding as “a way of indexing or categorizing the text in order to establish a framework of thematic ideas about it” (p.39). That is, coding refers to the manner in which one defines or labels the data he or she is analysing. In coding her/his data, the researcher identifies and records one or more passages of text. Usually, several passages are identified and they are then linked with a name for that idea. Thus all the text about the same thing is coded to the same name. The focus of coding was mainly on finding text that describes or could be used to describe teachers’ interpretation and use of concepts in teaching technology education or her/his actions.

To improve reading or identification of information it is important that codes are clearly tabulated. In Tables 4.2 and 4.3 different sources of data and types of data or excerpts are respectively coded. With Table 4.2 we are able to trace the source of information provided by the participant whereas Table 4.3 provides us with the type of data or excerpts that participants provide from sources such as interviews.

**Table 4.2: Codes for sources of data**

<table>
<thead>
<tr>
<th>Code</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITW</td>
<td>Interview</td>
</tr>
<tr>
<td>OBV</td>
<td>Observation</td>
</tr>
<tr>
<td>DCS</td>
<td>Documents</td>
</tr>
<tr>
<td>QTN</td>
<td>Questionnaires</td>
</tr>
</tbody>
</table>

**Table 4.3: Codes and coding for different themes and/or categories of data**

Themes and/or categories are derived from the theory that underpins the study and in some instances research questions are the source. In this study coding is mainly from the research questions. In addition, excerpts are coded according to the category in which they belong to facilitate easy identification and reference when results and/or findings are discussed. For example an excerpt can represent information under category TCU as TCU 101.
<table>
<thead>
<tr>
<th>CODES</th>
<th>Themes/categories</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTP 300</td>
<td>General Teacher Practices</td>
<td>This category describes the general practices of a teacher i.e. it answers the main research question.</td>
</tr>
<tr>
<td>TCK 200</td>
<td>Teacher Content Knowledge</td>
<td>In this category the subject matter knowledge of the teacher is described. That is, the teacher’s conceptual understanding is reflected.</td>
</tr>
<tr>
<td>TSM 200</td>
<td>Teacher Strategies &amp;Methods</td>
<td>This category is used to indicate specific strategies and/or methods that the teacher uses in his/her teaching of a specific topic or its concepts.</td>
</tr>
<tr>
<td>TCU 100</td>
<td>Teacher Conceptual Understanding</td>
<td>The basic themes are mostly focusing on individual concepts or activities that the teacher engages in. In this theme, individual understanding of concepts the teacher possesses is analysed or described.</td>
</tr>
<tr>
<td>TCC 100</td>
<td>Teacher Contextual use of Concepts</td>
<td>Concepts are mostly contextual. That is, they are used in different contexts differently. Here the analysis is on how the teacher in practice uses these concepts.</td>
</tr>
<tr>
<td>TMC 100</td>
<td>Teacher Method Choice</td>
<td>There are many methods that the teacher may use depending on the context. That is, context determines the type of method that may be used to enhance learning. In this category the teacher’s selection or choice of method is assessed against the type of content being taught.</td>
</tr>
</tbody>
</table>

It is also important to draw networks to illustrate the flow of the data analysis process (see Figure 4.1).

![Figure 4.1: Thematic data analysis network (T-DAN)](image-url)
The network processes and outcomes are diagrammatically described in Figure 4.1. That is, in this diagram, analysis can be a combination of information from any category depending on what meaning it carries to respond to a research question. That is, meaning can be generated between basic themes or across the different themes the researcher has constructed to answer research questions. In the current study three themes, basic, organising and finally the global theme were constructed. The complexity of the network increases with data and what research questions require. Components of basic themes can be synthesised to generate meaning or make sense that results in the organising themes. The same process may happen horizontally, vertically and diagonally across the network to generate meaning and understanding. Finally, in this study the two organising themes (generated from research-sub-questions) are synthesised to produce the information that answers the main research question. From the organising themes, one is able to see how individual research sub-questions were answered, leading to the answering of the main research question.

In the next paragraph, data that was drawn through themes is used. That is, the results and the synthesis are described using selected data from different sources.

### 4.1.2 Results and analysis

In this section data collected from all the sources is presented. The data presented here represents and/or reflects individual teachers’ teaching practices. In other words, this data presents the knowledge and in some instances related actions in the teacher’s teaching situation. Each teacher’s information was analysed separately as their knowledge and practices are considered idiosyncratic. First, Mrs Morula’s data and results are presented.
Table 4.4: Analytical framework of teacher knowledge and practices of Mrs. Morula

<table>
<thead>
<tr>
<th>Key: Basic themes (TCU, TCC, TMC, TSE)- Organising themes (TCK, TSM)- Global theme (GTP)- Question (Q)- Response (R)- Observation (OBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CASE1: Mrs. Morula</strong></td>
</tr>
<tr>
<td><strong>Basic theme/s (TCU,TCC,TMC,TSE)</strong></td>
</tr>
<tr>
<td>The basic themes are of categories that are informed by the organising themes. The responses in this category are formulated from the sub–research questions. This category is concerned with how the teacher teaches particular technology education concepts. They also describe how technology teachers teach a particular subject content in a specific context.</td>
</tr>
<tr>
<td><strong>Organising theme (TCK &amp;TSM)</strong></td>
</tr>
<tr>
<td>The organising themes are categories that are informed by the Global theme. It concerns the content knowledge, teaching strategies and the methods that the teacher is demonstrating in the classroom during observations.</td>
</tr>
<tr>
<td><strong>Global theme (GTP)</strong></td>
</tr>
<tr>
<td>The global theme is a category that deals with the main research question. All other sub-research questions are built from this category. Answers from this category are based on the General Teaching Practices of teachers.</td>
</tr>
</tbody>
</table>

| **TCU/TCC 100** |
| Q 01:[TCU101]: Why do you use prior knowledge as an introduction before the actual lesson and why? |
| R 01: to draw learners’ attention- for easy participation of learners.] |
| Q 02:[TCU102]: What is your understanding of the concepts? stiffness, flexibility and rigidity of materials |
| R02:Defined concepts verbatim from hand-outs, |
| Q 03[TCU103]:What is the role of practical work in teaching? |
| R 03: [TCC104]:It is a hands on activity- for better understanding... ...watch them doing activities – child-centred approach] |
| **TCC100** |
| OBS;[TCC101] lesson presentation- teacher demonstrates ability to present the lesson |
| OBS; Summarises material in the concluding part] |
| Q02[TCC 102]How do you make the lesson |
| **TCK 200** |
| The teacher’s response indicates what she did in the context in which she had to teach this unfamiliar subject. In this category a synthesis of the teacher’s understanding of certain concepts is made. It is apparent from her responses as to her approach to the teaching of concepts related to the topic at hand. From her use of manual to define and teach concepts one can infer her level of understanding and use of concepts as more reliant on the manuals she is using [TCU102, Q02, R02; TSE101, Q01, R01].Her approach of using manuals verbatim or with limited explanation confirms her assertion regarding her limited experience in teaching the subject or its concepts (i.e. stiffening and rigidity and flexibility of materials) [TCC 103, Q02, R02]. |
| **GTP 300** |
| In an attempt to answer the research question about the teacher in her practice, a few aspects have been identified. It is clear from the analysis that some aspects could not be accessed. However, what is reported here gives some important insights as to this teacher’s practices. It is also clear that the teacher was limited in her practices. That is, the teacher did not have sufficient resources to teach, especially in her practical work. What has been established though include the following: |
| Conceptual understanding of subject matter and teaching strategies. |
| It was not clear as to the level of subject matter the teacher possessed. It was only going to be possible to establish this aspect sufficiently if the teacher had demonstrated some |
### Q01 [TSE101]: How do you teach technology concepts?

**R01**: Using information from hand-outs.

### Q02 [TSE102]: Does the DBE provide the school with learning materials?

**R02**: Instructed to order only one kind of a textbook -but not enough to cover all the learners.

### Q03 [TSE103]: How do you encourage learners in designing their own models?

**R03**: By requesting them to collect for materials at home.

### Q04 [TSE104]: How do you teach technology concepts?

**R04**: Using information from hand-outs.

### TSM 200

In this category a synthesis of the methodological approaches of the teacher is made. Clearly the teacher had to come up with strategies relevant to different situations when teaching different concepts. What is clearly dominant in the teacher’s approaches is that she followed a particular sequence of doing things [TCU101, Q01, R01; TCC101, Q01, R01; TCC101, OBS]. That is, the teacher is aware of the importance of the quality of prior knowledge if the learners are to understand a new topic. She also indicates the aspect of knowledge consolidation at the end of teaching by summarising what the teacher has to some extent an understanding of the concepts of teaching. From her explanation one could infer that the teaching perspective is drawn from constructivism. This was apparent in her indication of the importance of establishing prior knowledge at the beginning of her lessons. Prior knowledge assists in knowledge construction for the teacher and the learner in a teaching and learning situation.

Practical teaching activities and/or practices

What was clear about this teacher is what the aim of technology education is, that is, to develop an innovative and practical learner. This assertion is based on her reliance on improvisation.

### TSE100

**Q01**: How do you teach technology concepts?

**R01**: Using information from hand-outs.

**Q02**: Does the DBE provide the school with learning materials?

**R02**: Instructed to order only one kind of a textbook -but not enough to cover all the learners.

**Q03**: How do you encourage learners in designing their own models?

**R03**: By requesting them to collect for materials at home.

**Q04**: How do you teach technology concepts?

**R04**: Using information from hand-outs.

### TMC100

**Q01**: How do you approach challenges when applying technology education concepts?

**R01**: By using improvised learning materials for explanation of concepts in her teaching. The difficulty in establishing this aspect is due to the teacher’s reliance on using manuals verbatim in explaining concepts.
learners to understand the concepts and apply strategies that will cater for all learners with different learning abilities.

Q02 [TMC102]: Which methods do you use when teaching technology concepts?
R02: Hands on activity and question and answer method.

Q03 [TMC103]: How do you approach challenges when applying technology education concepts?
R03: Gather information from textbooks borrowed from other schools and giving remedial work to learners with low capabilities.

Improvisation is a sign that one has to be innovative. Innovation is at the core of technology education as a subject in schools. In addition, allowing learners to develop models as this teacher claims to have done, points to her strength of teaching such a subject although she was not experienced in teaching the subject.

In conclusion, it is apparent that the teacher was limited by lack of resources. Thus our understanding of her abilities may have been compromised by the teaching context the teacher found herself in.

<table>
<thead>
<tr>
<th>Case 2: Mr. Phepeng</th>
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<tbody>
<tr>
<td><strong>TCU/TCC100</strong></td>
</tr>
<tr>
<td>Q 01 [TCU101] How do you introduce a lesson? R 01: By asking questions from the previous work e.g. what is technology education ...human needs and wants/the use of knowledge, skills and values?</td>
</tr>
<tr>
<td>Q 02 [TCU102] How do you define system and control concepts? R 02: Pulley and gear-gear is a wheel with teeth around its edges. Pulley-a wheel with a belt around its groove.</td>
</tr>
<tr>
<td>Q 03 [TCC103] How do you explain technology concepts? R 03: Use explanations from hand-outs and make them short for better understanding.</td>
</tr>
<tr>
<td>Q 04 [TCC104] How do you teach concepts to be understood by learners? R 04: Use available learning materials in class.</td>
</tr>
<tr>
<td><strong>TCK100</strong></td>
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<tr>
<td>Under this category, the aim was to synthesise the teacher’s content knowledge or subject matter and the strategies and/or method the teacher engages to teach his learners. The teacher indicates an approach of first establishing the relevant knowledge his learners have as a basis for teaching the new concepts. The teacher demonstrates an accurate definition of the concepts that are used in the topic “system and control”. However, the teacher</td>
</tr>
<tr>
<td><strong>GTP 300</strong></td>
</tr>
<tr>
<td>In both the TCK and TSM sub-themes, distinct ways the teacher possesses his knowledge will be exposed. That is, the pedagogical knowledge in understanding the subject matter will be explained. The necessity in explaining how to describe the structure of his concepts and/or his knowledge is important. It is also imperative to give a detailed use of his knowledge in the context of engaging in the teaching practices described. In reporting the outcomes of this analysis, the excerpts explaining the quality of knowledge of the teaching</td>
</tr>
</tbody>
</table>
such as door handles and bicycles.

relied on the hand-outs that are provided [TCC103, Q03, R03]. It is apparent that without these hand-outs the teacher may not necessarily be able to use other means or ways of explaining the concepts [TCC104, Q04, R04].

practices can be made easy. The following describe the importance of the teacher in the teaching practices performed during classroom observation.

<table>
<thead>
<tr>
<th>TSE100</th>
<th>TSM200</th>
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</thead>
</table>
| **Q 01 [TCC101]** What knowledge and skills do you have regarding technology concepts?  
**R 01** I wanted to understand more of technology concepts by enrolling with UNISA and KZN and acquired ACE in technology education. | **Teaching strategies and/or methods used by teachers depend on the extent of the teacher’s subject matter knowledge and the context in which they teach.**  
He indicates that his experience [TCC105, Q03, R03] and qualification [TCC101, Q01, R01] assist him in his teaching. The teacher believes that the more one is exposed to teaching the subject, his/her knowledge of the subject is enhanced [TCC105, Q03, R03]. However, the teacher concedes that even if one has experience, there is the need to have relevant learning materials to succeed in effective teaching of the subject [TMC101, Q01, R01]. On the teaching approach, the teacher believes in involving learners although this is hampered by the large number of learners in a class [TMC03, Q02]. |
| **Q 02 [TCC102]** How do you teach technology concepts?  
**R 02** I use verbal teaching without learning materials. | **Conceptual understanding of subject matter and teaching strategies.**  
To reveal and explain the importance of knowledge it is necessary to focus on more than one concept together with other related concepts. This means that a concept has its meaning when it is clustered with other relative concepts. In describing the quality of knowledge one cannot do so by focusing on individual concept without their associate concepts. That is, a concept cannot be a concept without context or in relation to other concepts. For this teacher:  
The understanding of most of the concepts was limited to definitions. This means the teacher tried to explain and define concepts. He also tried to use them appropriately in other situations of the teaching practices. The understanding of the teacher was limited and indicated or the limited knowledge about the subject matter to be learned and taught.  
**Practical teaching activities and practices.**  
In ensuring that teachers are effective in teaching technology education, they need to be well |

<table>
<thead>
<tr>
<th>TMC100</th>
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</table>
| **Q 01 [TMC101]** How do you perform practical work with the learners?  
**R 01** There are no resources to perform practical work  
**Q02 [TMC102]** How does the hand-outs help you in teaching technology concepts?  
**R 02** Text books are not enough hence the issuing |  |
of hand-outs

<table>
<thead>
<tr>
<th>Q 03 [TMC103]</th>
<th>Which methods do you use to teach technology concepts?</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 03</td>
<td>I use learner involvement method.</td>
</tr>
<tr>
<td>Q 04 [TMC104]</td>
<td>How do you assist the learners to understand technology concepts?</td>
</tr>
<tr>
<td>R 04</td>
<td>By giving them remedial work and doing corrections with them.</td>
</tr>
</tbody>
</table>

Q03, R03; TMC04, Q04, R04]. acquainted with knowledge of technology as a concept and ability to represent it at all levels of conceptualization. In the case of this teacher, this was his area of co. The teacher’s knowledge of application level was more on content with fewer activities and no practical work had been done. The teacher could therefore have an impact on learners’ learning. This means that the teacher could not relate his knowledge to other technology education text books but used his experience and knowledge acquired professionally. The teacher found it difficult to construct meaning from the concepts he was defining and attempting to explain to learners.

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**Case 3 : Mrs.Nku**

<table>
<thead>
<tr>
<th>TCU/TCC100</th>
<th>TCK200</th>
<th>GTP300</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Q 01 [TCU101]</strong> How do you introduce a lesson?</td>
<td><strong>This teacher has clearly made the concept of ‘technology’ an important part of her lesson hence the need for her learners to understand what it is</strong> [TCU101, Q01, R01]. The teacher uses models (wheels) to assist her in explaining some of the concepts [TCC103, Q03, R03]. Technology education requires the use of tools to reinforce understanding and promote innovation among teachers and learners. For example, in explaining the concept “pulley”, the learners will not only learn but will physically see what it means. In explaining her level of knowledge, the teacher refers to her professional qualification as the basis of her knowledge. In addition, the teacher believes her diploma in physical</td>
<td></td>
</tr>
<tr>
<td><strong>R 01</strong> By defining technology as a concept...Technology - use of knowledge, skills and resources to meet human needs and wants.</td>
<td><strong>Technology</strong> requires the use of tools to reinforce understanding and promote innovation among teachers and learners. For example, in explaining the concept “pulley”, the learners will not only learn but will physically see what it means. In explaining her level of knowledge, the teacher refers to her professional qualification as the basis of her knowledge. In addition, the teacher believes her diploma in physical</td>
<td></td>
</tr>
<tr>
<td><strong>Q 02 [TCU102]</strong> How do you define system and control as a concepts?</td>
<td><strong>GTP300</strong></td>
<td>**In both the TCK and TSM sub-themes, distinct ways the teacher possesses her knowledge will be exposed. That is, the pedagogical knowledge in understanding the subject matter will be explained. The necessity of explaining how to describe the structure of her concepts and/or her knowledge is important. It is also imperative to give a detailed use of her knowledge in the context of engaging in the teaching practices described. In reporting the outcomes of this analysis, the excerpts explaining the quality of knowledge of the teaching practices can be made easy. The following describe the importance of the teacher in the teaching</td>
</tr>
<tr>
<td><strong>R 02</strong> Gear is a wheel with teeth around its edges. Pulley is a wheel with a belt around its groove.</td>
<td><strong>The teacher</strong> uses models (wheels) to assist her in explaining some of the concepts [TCC103, Q03, R03]. Technology education requires the use of tools to reinforce understanding and promote innovation among teachers and learners. For example, in explaining the concept “pulley”, the learners will not only learn but will physically see what it means. In explaining her level of knowledge, the teacher refers to her professional qualification as the basis of her knowledge. In addition, the teacher believes her diploma in physical</td>
<td></td>
</tr>
<tr>
<td><strong>Q 03 [TCC103]</strong> What did you use to assist you in explaining concepts?</td>
<td></td>
<td>**In both the TCK and TSM sub-themes, distinct ways the teacher possesses her knowledge will be exposed. That is, the pedagogical knowledge in understanding the subject matter will be explained. The necessity of explaining how to describe the structure of her concepts and/or her knowledge is important. It is also imperative to give a detailed use of her knowledge in the context of engaging in the teaching practices described. In reporting the outcomes of this analysis, the excerpts explaining the quality of knowledge of the teaching practices can be made easy. The following describe the importance of the teacher in the teaching</td>
</tr>
<tr>
<td><strong>R 03</strong> I used small wheels with serrated edges</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Q 04 [TCU104]</strong> What knowledge and skills do you have regarding the understanding of concepts?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R 04</strong> Through experience and the knowledge acquired from my professional qualifications.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Science may be adding to her ability to teach technology. This is the case as Science and Technology share concepts [TCU104, Q04, R04]. Complementing her knowledge through qualifications, the teacher believes her engagement in subject meetings has enhanced her confidence in teaching technology [TMC103, Q02, R02].

<table>
<thead>
<tr>
<th>TMC100</th>
<th>TSM200</th>
<th>Conceptual understanding of subject matter and teaching strategies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 01 [TMC101]: Were you formally trained to teach technology education?</td>
<td>R 01 - No formal training until acquired (Diploma) in physical science</td>
<td>In describing the quality of knowledge, one cannot do so by focusing on individual concept without their associate concepts. That is, a concept cannot be a concept without context or in relation to other concepts. For this teacher: The understanding of most of the concepts was limited to definitions. This means the teacher tried to explain and define the concepts. She also tried to use them appropriately in other situations of the teaching practices. The teacher’s understanding was not satisfactory and indicated little or no subject matter knowledge to be learned and taught.</td>
</tr>
<tr>
<td>R 02 I am confident due to my experience and cluster meetings I attend.</td>
<td>Q 02 [TMC102]: Are you confident enough when teaching technology education concepts?</td>
<td>Practical teaching activities and/or practices.</td>
</tr>
<tr>
<td>Q 03 [TMC103] Do you have an understanding about the subject matter? R 03 I organize information to the extent that it will be easily understood by learners.</td>
<td>R 04 Not all the learners are given special attention.</td>
<td>In ensuring that teachers are effective in teaching technology education, they need to be well acquainted with knowledge of technology as a concept and be able to represent it at all levels of conceptualization. In the case of this teacher, this was her area of concern: One of the important</td>
</tr>
<tr>
<td>Q 04 [TMC104] How do you cope with the number of learners in class?</td>
<td>R 04 The use of chalkboard and improvisation of learning materials.</td>
<td>practicals performed during classroom observation.</td>
</tr>
<tr>
<td>Q 05 [TSE101] Which method do you use to teach technology education concepts?</td>
<td>R 01 Discovery method</td>
<td></td>
</tr>
<tr>
<td>Q 02 [TSE102] How do you engage learners in the lesson?</td>
<td>R 02 By question and answer method</td>
<td></td>
</tr>
<tr>
<td>Q 03 [TSE103] How do you teach technology education concepts?</td>
<td>R 03 The use of chalkboard and improvisation of learning materials.</td>
<td></td>
</tr>
<tr>
<td>Q 04 [TSE104] How does improvisation of materials assist you during the teaching practices?</td>
<td>R 04 The learners at least have an idea of what gears look like.</td>
<td></td>
</tr>
<tr>
<td>R 05 [TSE105] How does improvisation of materials assist you during the teaching practices?</td>
<td>R 06 Effective teaching is guided by</td>
<td></td>
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</tbody>
</table>

Conceptual understanding of subject matter and teaching strategies. In describing the quality of knowledge, one cannot do so by focusing on individual concept without their associate concepts. That is, a concept cannot be a concept without context or in relation to other concepts. For this teacher: The understanding of most of the concepts was limited to definitions. This means the teacher tried to explain and define the concepts. She also tried to use them appropriately in other situations of the teaching practices. The teacher’s understanding was not satisfactory and indicated little or no subject matter knowledge to be learned and taught.

Practical teaching activities and/or practices. In ensuring that teachers are effective in teaching technology education, they need to be well acquainted with knowledge of technology as a concept and be able to represent it at all levels of conceptualization. In the case of this teacher, this was her area of concern: One of the important
<table>
<thead>
<tr>
<th>Q 05 [TSE105]</th>
<th>Do you manage to reach the outcomes at the end of your lessons?</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 05</td>
<td>Outcomes not reached due to learners not involved in practical work and overcrowding of learners?</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Q 06 [TSE106]</th>
<th>Do you prepare yourself before the actual lesson?</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 06</td>
<td>The lesson plan is always available.</td>
</tr>
</tbody>
</table>

|                      | what the teacher has done in the classroom. That is, the plan must reflect what was done. It should change with the context in class. The teacher also created a situation where learners can experience, instead of simply delivering plain information. The response TSE105, R05 is valid hence the teacher only used examples of gear. Examples of pulleys were not available. The answer is valid in a sense that the teacher did not use concrete objects and other examples to teach about pulleys. At the end of the lesson the teacher did not involve learners in any practical work. That would suggest that the teacher still lack in some aspects of the knowledge to teach technology education subject matter. Overcrowding of learners in a classroom is also a challenge. It affects the effective teaching of technology concepts to attend to learners’ problems individually. The answer to TSE106, Q00, R06 is relevant but contradicts what the teacher has done during the lesson. The interesting part of the lesson was only in the introduction of the actual lesson where the teacher was using improvised gears to teach the concept. |
|                      | attributes in understanding and using technology concepts is the ability to represent it at all levels of conceptualization. In the case of this teacher, this was her area of concern: The teacher's knowledge of application level was more on content with one activity directed to learners and no practical work had been done. The teacher had less impact with the learners. That indicates that the teacher could not relate her knowledge to other technology textbooks but used her experience and knowledge acquired professionally. The meaning from the concepts was limited to explanations and definitions |

Teacher interpretation and use of concepts in teaching in general, and in teaching technology in particular, involves transformation of subject matter knowledge in the context of facilitating student learning (Shulman, 1986). Teachers’ professional insight and actual teaching practices may differ from one teacher to the other. The results and discussions that follow illuminate what the teacher did or did not do in the classroom setting.
4.2 FINDINGS

This study had mainly two important purposes regarding teacher practices in teaching technology education. The purposes were to establish their understanding of the concepts generally used in the teaching of technology for Grade 9 learners and linking this understanding to the actual teaching practices of technology education under the school curriculum of the South African education system. Thus the reporting was categorized as teachers’ understanding of concepts in the teaching of a technology topic and teachers’ teaching of particular concepts of this topic. The sequencing of the reporting was an attempt to coherently answer the two sub-questions on the “what” and “how” of the main research question.

4.2.1. Teachers’ understanding of concepts in the teaching of a technology topic

In this section, the teachers’ interpretation and use of concepts in the teaching of technology will be discussed. There needs to be an understanding that teaching practices are essential building blocks for effective teaching and are important for improving educational processes. Professional competence is regarded as an important factor in the classroom setting and teaching practices (Talis, 2009, p. 90). Good teaching practices can be enhanced by using appropriate teaching methodologies. Teachers should further understand different teaching strategies that can be applied with different learners in the classroom. This, however, relates to the experience of having to perform certain learning activities that could be learned through being a learner and it is able to stimulate learning. In this study, this was done through interviews, observation, questionnaires and the documents that teachers used in their teaching of technology education. That is, these were the sources of data (Table 4.2) about teacher practices. These methods or sources of data were presented and identified with codes.

Data was collected from different sources for the purpose of analysis. The sources of data included observation, documents, interviews and questionnaires. The reporting of the results and the discussions thereof are based and sequenced according to the codes, themes/categories and descriptions in (table 4.3) The reporting will also be discussed for all cases under one sub-theme first, and then the other themes, so that findings and/or conclusions can be reached according to these themes or sub-themes as a reflection of the research questions.
4.2.1.1 Teachers’ Content Knowledge (TCK: 200)

In this category the subject matter knowledge of teachers is described. That is, teacher’s conceptual understanding is reflected.

Case 1: Mrs. Morula *

The results and discussions that follow reflect Mrs. Morula’s teaching practices as analysed from the data collected from different sources used and to a certain extent as inferred or synthesized by the researcher according to codes, categories and themes.

- **Teacher Conceptual Understanding (TCU: 100)**

  The basic themes are mostly focusing on individual concepts or activities that the teacher engages in. In this theme, individual understanding of concepts the teacher possesses are analysed or described.

  - From the researcher’s observation, the teacher introduced the lesson by asking the learners questions about concepts taught in the previous lesson (OBS).

  - The teacher believes that prior knowledge in the introduction draws the learners’ attention in the lesson (ITW).

    ‘‘... During my lesson in the class, I firstly start by asking my learners the previous knowledge [TCU: 101] from what they have learned. Thereafter I introduce the new lesson. During the new lesson, I will be giving them the theory about the lesson. At the same time, they will also be involved in doing hands-on activities or practical activities. As the lesson goes on, they will also be given some activities maybe in the form of writing or oral form of questioning...’’

    From the analysis it can be deduced that introducing the lesson can draw the attention of the learners in class.

  - She indicated that learners learn best when they do **hands-on activities** after giving them theory on concepts (ITW).

  - She also added that for the learners to understand the concepts better, it is imperative for the teacher to explain the properties of materials as a concept.
o The teacher asked learners questions and gave them feedback throughout the lesson.

“... It also depends on the type of method I’ll be using while busy teaching the learners. For example the method that I always use I make sure that it will be the one that the learners will be able to understand, especially when it comes to the theory part of the lesson. Again I know that when it comes to the hands-on activities [TCU103] or the resource type of activities, they will be easily participating. I know they understand much better when they do practical work [TCU104]. I just watch at them when they do activities [TCU105] that they can be able to touch and see than when you are just giving them theory part of it. I only give them guidance where necessary...”

It is clear that learners understand concepts better when they do practical work during the lesson. When learners understand theory first, it will be easy for them to do practical work on their own while their teacher is only giving them guidance where necessary. Practical work is important because it helps them to remember what they have been doing and to keep it in a long term memory. Practical work makes learners acquire skills and knowledge for future use. It encourages learners to work independently (learner-centred approach). Most of the time learners and teachers [improvise for materials in the lesson].

o The way structure resists the forces acting on it, depends on the materials from which it is made (DCS).

o She taught learners the properties of materials and how they differ from each other (OBS).

“... As I have said it takes me the whole term which is three months to complete a concept. So in a concept I will be looking at different things, for example, for the learners to know what the concept is about, the different ways in which the concept can be tackled and how to do it may be giving them some resource activities. For example in the structures they were doing the flexible materials and how to stiffen the materials [TCU106] that are available and we are doing some activities whereby they were practising them. The learners were busy doing those resource activities whereby they will be looking at how to stiffen the flexible materials. So each and every concept will be done within a term which is about three months...”
Explaining characteristics of concepts to learners is an important aspect in the teaching practice. Teaching technology concepts in the class shows the teachers’ understanding of the concepts. It also gives a clear understanding of the teacher’s knowledge and skills in the subject matter. A teacher with a deeper pedagogical knowledge understands how learners construct knowledge and acquire skills in differentiated manners.

**Case 2: Mr. Phepeng**

Mr. Phepeng’s teaching practices are reflected from the analysed data collected from his activities and/or documents he used in his teaching. Different sources were used to obtain the data below. To a certain extent inferences were drawn from data to conclude about his teaching activities or his understanding of concepts.

- **Teacher Conceptual Understanding (TCU: 100)**
  - The teacher asked learners questions on the concepts about the previous lesson. He also asked them to define the concept **technology** (OBS).
  - He defined the term technology as the response to human needs and wants. He said some defined it as the use of knowledge, skills and values to satisfy human needs and wants. Furthermore, he explained that some needs you cannot live without and the wants you can live without (ITW).

  “...*When you teach technology education there are different concepts you need to define (TCU: 101).*”

  “...*By teaching concepts and making them easy is when you make them short (TCU: 102). For a better understanding I try to come up with concrete examples, (TCU: 103) for instance a door handle is what they can see in a class.*”

It can be declared from the analysis that those definitions of concepts at the beginning of the lesson leads the learners to the actual lesson and what it is all about. Technology is defined as a form of human knowledge aimed at creating artefacts (Pavlova, 2005: 122). Therefore teaching should begin with a clear understanding of what is to be learned and taught. It emerged that when teaching unfamiliar concepts the teacher does not have to talk longer and more often. He also does not have to pose questions on a low cognitive level.
Case 3: Mrs.Nku *

Teachers teaching the same subject and topic have different understanding of the methods and/or concepts within the same topic. Data used for Mrs.Nku reflects her understanding of concepts. This data was collected from different sources to ensure a better understanding of her topic or its teaching. As in other situations, the data was collected using themes, sub-themes, categories and codes to construct meanings and/or understanding of this teacher’s teaching practices.

- **Teacher Conceptual Understanding (TCU: 100)**
  - The researcher observed the teacher introducing the lesson by asking learners questions on prior knowledge to define the concept of a pulley (OBS).
  - The participant further asked learners to give their own definition on what technology is (OBS).
  - After the attempts from the learners, the teacher defined the concept technology (TCU: 101) as follows (ITW):
    
    “...Technology is the use of knowledge, skills (TCU: 102) and resources to meet human needs and wants, to recognise and solve problems by technological processes such as investigating, developing, evaluating and communication of the product system and process by considering social and environmental factors...”
  - She distributed hand-outs to the learners to refer to while busy teaching learners (OBS).
  - The teacher introduced to the learner the concept of gears by drawing an example of a gear on the chalkboard. Therefore she showed to the learners the three objects with different sizes and serrated on the edges (TCU: 103) to teach them about the gears (OBS).
  - The objects the teacher was using as teaching aids, she bought herself because the school is not in possession of such kinds of teaching aids. (ITW).
  - During the lesson the learners seemed interested in the lesson as the teacher was introducing to them what gears look like and explaining their movements (OBS).
As the teacher was busy teaching, she continuously asked learners questions and they responded promptly to the questions asked (OBS).

The teacher used the lesson plan she had prepared to teach the lesson.

“...The understanding is so much because I have been teaching it for several years. I’m always guided by my lesson plan (TCU: 104) as a tool that needs to be followed during the technology lesson. Usually I plan my lessons before going to class...”

Only a few learners tried to respond to the questions asked but most of them looked puzzled. The introduction of teaching aids in the lesson drew the learners’ attention in the lesson. It was clear that learners became interested in the lesson and the teacher was able to reach the learning outcomes when the teaching aids were used. A teacher with content knowledge understands how learners construct knowledge in differentiated manner.

The lesson plan was well prepared. The introduction and the content of the lesson were well prepared and presented with examples of gears during the lesson. At the end of the lesson the teacher did not do any practical work with the learners to show them how gears effect a movement on each other. Therefore the concluding part of the lesson was compromised as the practical work was not done with the students due to lack of teaching resources.

4.2.1.2 Teachers’ Content Knowledge (TCK:200) (Continuation)

This category is used to indicate specific strategies and/or methods that the teacher uses in his/her teaching of specific topic or its concepts.

Case 1: Mrs. Morula*

Teacher Contextual use of Concepts (TCC:100)

- I noticed that the teacher used the lesson plan step by step during the lesson in the classroom (OBS).
- She improvised materials that the learners used in the classroom for performing the practical work (ITW)
- The teacher explained that the lesson plan was a teaching instrument that is used by the teacher to follow proper procedures as well as to manage them (ITW).
They will be using those materials for practical work or to do the hands-on activities with them. As a teacher I’ll make sure that sometimes I collect some materials [TCC:101] that I want them to use in the class since we do not have the enough resources at school. So by doing that, those activities will be easily done and it will become easy for the learners to understand technology concepts [TCC:102].”

Presentation of the lesson was very good up to the end. All the parts of the lesson plan such as the introduction, the body as well as the conclusion part were very interesting where the teacher was doing practical work with the learners.

- The teacher strongly agreed that technology teachers experience challenges in applying teaching practices in the classroom (QTN). She agreed that she is conversant with the knowledge and skills applied in technology education (QTN). She agreed that she is well versed with subject matter knowledge, but she still lacks the pedagogical knowledge for teaching the subject (QTN).

- From the comments the teacher explained that she specialised in technology when she was doing B.Ed. (Hons) (QTN).

- She also agreed strongly that teachers need to be developed to be technology literate (QTN).

“...They will be using those materials for practical work or to do the hands-on activities with them. As a teacher I’ll make sure that sometimes I collect some materials that I want to use in the class, since we do not have the enough resources at school. Teachers were not trained to teach technology education before [TCC: 103] as a profession, since it was not yet introduced as a subject. As I have explained earlier on, I enrolled with one of the universities so that I can be able to further my studies in technology. I was having a problem in teaching it...” “...Practical work will be easily done and it will become easy for the learners to understand...”

“... I decided to enrol with one of the universities to continue with my studies [TCC: 104]. I started to teach technology education since it was introduced in schools without teachers being trained in it. So I specialised in technology education when I was doing my B.Ed. Honours degree with the University of Pretoria. For the skills and knowledge that I have gained there, I think, are the ones that are helping me at the moment for my teaching practices in the class...”
It is important for the teachers to be trained and have the relevant qualifications to teach the subject. Performing practical work with the learners after the lesson, it shows the pedagogical knowledge of the teacher in teaching technology education. Content knowledge is the subject matter knowledge that is to be learned or taught (Harris et al. 2009). According to the department of education, learning takes place when learners learn by touching, smelling and tasting things.

The teacher focused on the new way of transmitting information to the learners instead of using traditional teaching method where the teacher is doing a lot of talking and the learners are listening without doing any practical work. In this typical case, Ableser (2012) attests that exemplary educators should facilitate learning in the classroom by structuring the learning environment in such a way that an educator is able to step back to enable learners to take an active role in their learning endeavour.

- During the interviews the teacher confessed that she acquired technology education knowledge through in-service training, workshops and academic institutions (ITW).

“... Before technology education was introduced I did not have any knowledge about teaching technology education, since it was just introduced during the OBE curriculum2005. At first we were having some problems. When I was studying for my diploma at the college, we were not trained in teaching technology education. As I have explained earlier on, I enrolled with one of the universities so that I can be able to further my studies in technology, since I was having a problem in teaching it...”

- Learners were squashed in the classroom. The teacher was unable to give remedy to learners with barriers to learning (OBS).

- The teacher reported that sometimes it becomes difficult to reach the outcomes because of the number of learners in the class and teachers being redeployed from schools (ITW).

“...I would say that sometimes I reach my outcomes (TCC: 105) only if I ask my learners some questions and they would be able to respond and/or when they are given some activities to do. Adding on that, if learners were able to follow the instructions carefully and do what was required of them. It would mean that they understand what they are doing and what they have been taught. It is then that I would say I have reached my outcomes. The other problem
that hinders me as a technology teacher to reach the outcomes, is that I teach 56 leaners in a class which is a big number (TCC: 106)...”

It is imperative for technology teachers to reach the outcomes at the end of the period. Many learners in a class would lead technology education teachers to be ineffective in their teaching. Redeployment in schools also disadvantages teachers because it limits the number of teachers in the school.

Case 2: Mr. Phepheng*

It is only in application of concepts that it can be concluded that there is alignment between the ‘what’ of concepts and the ‘how’ of such concepts. Data collected for this teacher was analysed to establish links between understanding and application.

- **Teacher Contextual Use of Concepts (TCC:100)**

  Concepts are mostly contextualised. That is, they are used in different contexts differently. Here the analysis is on how the teacher in practice uses these concepts.

  - The teacher followed the plan and it was well presented (OBS).
  - As a technology education teacher, he agreed that he is formally trained in this specialized field.
  - He further agreed that technology education teachers experience challenges in applying teaching practices in the classroom (QTN).
  - The teacher explained that he experienced lot of challenges in teaching the subject before he enrolled for ACE in technology education (INT).

  “...I wanted to know more on technology education (TCC: 101) by **enrolling with UNISA. I also registered with DUT doing practice in technology education. Then I obtained my ACE certificate in 2006...**”

The introduction and the body of the lesson plan went very well, except at the conclusion where the teacher was supposed to interact with the learners during practical work.

Lack of knowledge of technology concepts creates a barrier for self-confidence to teach the subject.
The researcher understands that a technology education teacher, who is technologically literate about the subject matter, does not experience many problems in teaching the subject. Therefore technology education teachers should have the content knowledge of the subject matter.

- The teacher used the chalkboard to explain the concepts when teaching during the lesson (OBS).
- He also used the hand-outs he gave to the learners to refer to the diagrams and to understand them better (OBS).
- He agreed that he is content with technology concepts applied in the classroom setting (QTN).
- During the lesson, questions were asked and feedback was provided immediately (OBS).
- Again he agreed that he is conversant with the knowledge and skills applied in technology, but on the other hand he agreed that teachers lack insight into procedural and conceptual knowledge (QTN).

“...Lack of learning materials and resources are the biggest challenges that I have in teaching technology education. In most of the teachings I do verbal teaching without learning materials (TCC: 102)...”“... When you teach the subject more often, you become knowledgeable in that content (TCC; 103). For example what I have learned most of the time is the assembling of materials...” “...The challenges we encounter most of the time, are because we do not have resources at our school. We improvise materials when making models (TCC: 104)...”

Learners understand better if the teacher is using learning materials for explanations and demonstrations. The only way for the teacher to reach his learning outcomes is to make sure that concrete objects are used. It contributes to learners’ motivation to learn. Improvisation of materials is not guaranteed because of the school being situated in a rural area. Other materials are not easily accessible. This type of subject should afford learners to develop their own design and models. In this case students should be allowed to come up with their own initiatives and solutions.
The teacher agreed that the department of education provides interventions to educators, but from the comment he specified that not enough interventions are done. They are scheduled for 12H00 to 15H00 which is not enough for content capacity building (QTN).

I think the department should budget for technological resources for both teachers and curriculum implementers to be used in classes and during interventions. Furthermore, all teachers and curriculum implementers should be equipped with technological knowledge through distance learning. It should not be skill development on ACE only, but even further than that (ITW).

“... Sometimes **improvise materials** to be used during lesson that are not available in schools and are difficult to get (TCC: 105). In schools where a teacher is in front of about 60 learners without any practical work it becomes difficult for learners to understand (TCC: 106)...”

The use of materials in the classroom indicates the pedagogical knowledge of the teacher. Technology is an advanced learning area which needs to be seriously taken into consideration for our learners to be able to love it. In order for the learners to have a thorough knowledge in the subject, they must practice it seriously in and outside the classroom.

The department of basic education needs to give more time for curriculum implementers to facilitate technology properly. Furthermore, considering the teaching periods for the subject, it emerged that the periods are inadequate to enable the teachers cover the lesson in question. Learner teacher ratio is also a serious problem especially during practical work. The learner teacher ratio has a negative effect on effective teaching and learning, particularly on practical work with learners.

**Case 3: Mrs.Nku**

Teachers, based on their experience and educational backgrounds, will teach the same concepts and topics differently. That is, the data collected for different teachers will reveal different ways of doing things. Mrs.Nku is no exception to other teachers in terms of teaching practices. She has demonstrated her way of teaching.
Teacher Contextual use of Concepts (TCC: 100)

- The teacher was not formally trained in this specialised field of technology. She attended workshops and cluster meetings as it was known by then as a subject (ITW).

- The teacher seemed to have the knowledge about the subject matter hence she brought the examples of gears to the class and used them in a way that gave learners an idea of what a gear looks like (OBS).

- From the questionnaires the teacher agreed that she is conversant with the knowledge and skills applied in technology education (QTN).

“…Before I was employed at this school as a technology teacher, I was not trained to teach the subject (TCC: 101). The school has taken me, being a science teacher, because technology is a science subject with parts of science in it. The department identified me for further education and training in the natural science subject with Turfloop University for two years. I am partially confident in teaching technology…”

“…Yes, I am so confident when teaching the subject (TCC: 102) as I have been teaching it for several times and I attended workshops and cluster meetings on technology education is a new subject…”

The teacher is confident in applying technology in the classroom practice because she managed to spend most of the time on content, using the teaching aids with the learners and that is where they learn best. It is imperative for teachers to have a thorough content knowledge. This means that teachers should be well versed in the teaching strategies.

From the comments, the teacher explained that she acquired the knowledge and skills due to the experience she has.

- The teacher disagrees with the statement that teachers lack procedural and conceptual knowledge (QTN).

“…I have the skills in teaching Technology Education (TCC: 103) that I acquired at the University of Turfloop for two years. Learners are trying to cope, but due to limited time allocated for teaching periods and lack of resources (TCC: 104) for doing practical work, work has not been done satisfactorily…”
It emerged that the participant disagrees with the sentiment that teachers have no procedural and conceptual knowledge about the subject. The fact that no practical work was done in class, in itself does not constitute lack of procedural and concept knowledge, but rather lack of teaching resources.

As regards to knowledge of the teachers, workshops and other interventions played a role in developing the teacher’s knowledge in teaching technology education.

It further emerged that the minimum time allocated to teach technology education and lack of resources in the school contribute to teachers’ struggle to teach the subject.

4.2.1.3 Teacher Strategies and Methods (TSM: 200)

The strategy is used to indicate specific strategies and/or methods that the teacher may use in his /her teaching of specific topics or its concepts

Case 1: Mrs. Morula *

- Teacher Method of Choice (TMC: 100)

There are many methods that the teacher may use depending on the context. That is, context determines the type of method that may be used to enhance learning. In this category the teachers’ selection or choice is assessed against the type of content being taught.

- Demonstration in the classroom during the lesson with the learners indicates the pedagogical knowledge of the teacher.

- The teacher used question and answer method to teach the learners. Questions were asked throughout the lesson and feedback was given to the learners continuously (OBS).

- During the lesson observation in class, the teacher used the chalkboard as a soft material to teach the learners. She also used hand-outs for learners instead of textbooks (OBS).

- Text books are too few to cater for all the learners. She explained that most of the time they improvise learning materials to teach the learners. She further explained that the school is situated in a remote area where there are no laboratories and workshops to perform experiments with the learners (ITW).
From the questionnaires, the teacher confirmed that the department of basic education does not supply enough teaching resources for teaching technology education, such as textbooks (QTN).

The teacher gave learners enough opportunity to do the practical work on their own while busy supervising those learners (OBS).

From the questionnaires, the teacher agreed that teachers lack an appropriate teaching methodology for teaching technology education (QTN).

At the end of the lesson, the learners were given an activity to write in the form of class work (OBS).

“...The department of basic is providing us with some few text books. Now that the procedure of supplying the schools with textbooks has changed, we are most of the time instructed to give or to order one name of a text book [TSE:101] that we can use for technology. As a teacher I do not believe in such a thing. Most of the time I refer to different textbooks to find out about how different authors understand some concepts. So if I am using only one type of a textbook, it means that I will be confined to one resource material.

So we are also struggling at the moment with the study materials which are supplied by the department of basic education. Then as for the resources, as I have already mentioned earlier, we do not have the resources at schools [TSE:102]). All the resources we are using in schools have been improvised which are the ones we have collected outside the school or at home. Those materials are the ones that will be helping us when we do some activities. So we are really struggling in this regard...

...To me a big challenge [TMC: 101] is that when I encounter any problem about technology, there is no one to resolve it. The people whom we think will offer some help, are unable to resolve the problems we are encountering. Even though there is a problem that needs a special attention, they would take time to attend to it.

The curriculum implementers should also undergo a formal training to acquire knowledge and skills to facilitate technology education properly. It should be effective and efficient training.
Case 2: Mr. Phepeng*

Teacher Method of Choice (TMC: 100)

- From the researcher’s observation, the teacher did not perform any practical work with the learners after giving them theory (OBS).

- The teacher only used hand-outs for the learners to have an idea from the drawings of pulleys and gears (OBS).

- He also used the chalkboard to draw sketches as he was busy explaining the movement of gears (OBS).

- He denied that the department of education is supplying enough resources for teaching technology in schools (QTN).

- The challenge that the teacher encounters most of the time is lack of resources. They improvise materials when making models (ITW)

“... No special place where we can perform practical work (TMC: 101) with the learners. We do them in class. There is no storeroom to put the completed models; we put them in the staffroom. We keep them so that we can use them as teaching aids in future...”

“...The textbooks are not enough for the learners (TMC: 102) since the department delivered the textbooks in 2009. It takes 5 years for the school to receive new textbooks. There is no replacement of the textbooks; we rely on hand-outs for reference...”

It is clear that practical work unfreezes learners from where they are held up. It relates to the experience of having to perform certain activities through being a learner and it is able to stimulate learning. The teacher did not perform any practical work with the learners after the lesson. Therefore the approach was not child-centred, the lesson was not conducive to learning and the teacher did not reach the lesson outcomes.

Using the learning materials to teach the learners in class shows the pedagogical knowledge of the teacher of the subject. The knowledge and skills that the teacher is conversant with, are not properly applied.

- The learners in class were 60 in number for one teacher. The teacher asked questions throughout the lesson and was giving learners feedback immediately (OBS).
At the end of the lesson the teacher gave learners an activity in the form of class-work and the learners were provided with corrections after writing (OBS).

The teacher only used door handles and referred learners to bicycles and car engines to have a look at how gears and pulleys effect a movement on each other at home (OBS).

The teacher was unable to involve learners in practical work because of lack of resources in the school (ITW).

From the general comments the teacher argued that technology education is a practical subject. It needs a conducive environment were learners are not overcrowded and are able to perform practical skills. He suggests that the teacher ratio be reduced to 1:30 (QTN).

"...The method that is more relevant, I can say is the ‘learner involvement method (TMC: 103)’ because the learners are more actively involved, more than their teacher. Learners share ideas especially when you give problems to solve and activities to act on...” “...Some pupils need remedial work and writing activities after. I do corrections with them (TMC: 104). Informal activities help the learners to practise a lot so that when they write formal activities, they get to write them better...”

Due to the number of learners in the class, the teacher was unable to attend to the learners with low capability. Furthermore, resource constrains in the school such as laboratory and materials could result in a situation where a teacher is unable to integrate technology concepts into the classroom practice.

From the fact that learners were referred to examples of pulleys and gears at home, it shows that the teacher used a traditional teaching method in the classroom to teach the subject. The lesson was a teacher-centred rather than a learner-centred approach. This suggests that a teacher should possess subject-specific professional knowledge of the practice of teaching.
Case 3: Mrs.Nku *

Teacher Method of Choice (TMC: 100)

- The participant agrees that teachers lack appropriate teaching methodology for technology education (QTN).

- What the researcher has discovered from the observation in class is that the teacher did not give learners an opportunity to touch and observe the type of teeth that were on the teaching aids. She only gave them an example of a gear on bicycles (OBS).

“...The discovery method: (TMC: 101) is the first one because the learners will not easily forget. When they do the discovery activity themselves and writing something, they will never forget what they have been taught or did. The second one is the question and answer method that I use to interact (TMC: 102) with learners during the lesson…”

The researcher differs with the teacher concerning the discovery method she claimed to be using. The learners do not discover things on their own because of safety concerns regarding how to use the apparatus and not all the learners will do that activity due to lack of resources.

It emerged from the findings that learners only experienced the question and answer method that was used throughout the lesson which is the method that helped the teacher to interact with learners. A lack of resources hampers the teachers to be effective in their teaching practices.

- The teacher indicated that the department of basic education do not supply enough resources for teaching technology education. She explained that they just receive LTSM and they improvise for practical equipment (QTN).

- She further explained that learners use textbooks but some share them because they are limited in number (ITW).

- The teacher used hand-outs to teach the learners and to make her work easy (OBS).

“...No, the school does not have a special place for any practical work (TMC: 103). We do not have such a place. We just do the project in the classroom, school hall or outside the classroom to manufacture that project. We always improvise for materials. We ask learners to collect any material (TMC: 104) that we can use such as cardboards, pieces of corrugated zinc and wood. In technology they use
knowledge, skills and resources considering environmental and social factors, so the learners in our area try their best to improvise the materials. From the previous concepts, they made bridges and wheelbarrows, some are beautiful and some are not…”

For teachers to be effective in their practice teaching, they should be provided with all the relevant teaching and learning materials.

- The time allocated for teaching technology is 30 minutes to cover all the aspects in one period (OBS).
- The teacher explained that to reach the outcomes it depends on the topic being discussed or maybe depending on the use of improvised teaching aids to make the learner understand (OBS).
- The teacher explained that the department does not provide adequate interventions to educators. There are only minimal interventions without follow-up visits (QTN).

“…During the training interventions our senior education specialists are trying to help us, but due to time constraints (TMC: 105), practical work has not been done satisfactorily. They just help us with content but when coming to practical work, they do not do it because they do not have resources. We do not understand what the problem is. They do not have the resources at all in the workshops. They just do content only…”

Time allocation for periods should be revised was well as resources to be supplied because they make teachers incompetent in their teaching practices. Full interventions could result in teachers being effective in their teaching practices. The teacher did not show learners how gears effect movement on each other. Learners only noticed from the teaching aids that gears have teeth on their edges. The practical part of it did not occur. Therefore the teacher partially reached the learning outcomes.
4.4 PRESENTATION OF RESULTS

Understanding and practices of technology concepts

In terms of the objectives of this study, whereby the investigation was conducted as to how grade 9 teachers explore their insight and to determine the implementation of their teaching practices on selected technology education concepts, the following data was obtained.

From section 2, twenty-four participants (who amount to 80%) indicated that teachers were not formally training in the specialized field as a technology teacher. The other 6 participants (who amount to 20%) furthered their studies through different universities. They further stated that the training they received from the department of education, that took a period of 5 days, was inadequate. This is due to the fact that the departmental officials seemed to be unsure and confused as to what they were supposed to do. Some of the remarks made by participants was that the intervention sessions in most cases were confusing and rushed for time, lasting only from 12h00-15h00. Two participants (who amount to 6.7%) agree that the department of education provide adequate interventions to educators. Twenty-eight participants (who amount to 93.3%) are against the motion. The structure and methodologies of the new system were not clearly explained and discussed.

From the questionnaires in section 3, twenty three participants (who amount to 76.7%) agree that technology teachers experience challenges in applying teaching practices in the classroom. One participant (who amounts to 3.3%) is indifferent. Six participants (who amount to 20% of the participants) stated that they are becoming comfortable as to what is required from them in terms of technology education teachers’ teaching practices. Now that the RNCS (Revised National Curriculum Statement) has been changed to CAPS (Curriculum Assessment Policy Statement) it is more accessible in terms of interpretation and translation into practice. Although their understanding of RNCS has improved, they are still struggling to teach the subject and they are further not content with technology concepts in practice. They are also aware that coming to an understanding of technology concepts is a process that will obviously take some time.

Apart from the 20% of participants who stated that they are “comfortable” concerning the understanding of technology concepts, the remaining 76.7% of participants stated that they still experience problems and as such lack necessary insight regarding technology concepts which remains a concern. The other 6.6% of them agree to the statement while the remaining
16.7% are indifferent. In light of all these factors, it is clear that most of the participants seem to be lacking appropriate teaching practices for technology education. Some of the factors that contribute to these feelings of uncertainty are the fact that they were schooled in the old way of teaching. Thus they are struggling to take the step towards attaining good participation in the technology education process.

Fifteen participants (who amount to 50%) agree that teachers lack appropriate teaching methodology for technology education concepts. The remaining 50% of participants strongly agree to the same statement and none of them are indifferent. They felt that they do have an adequate understanding of technology concepts, but they are still struggling to translate theory into practice effectively. Many of the training workshops that were held were more learning area directed and not practical or making concepts clear. Although most of the respondents prepare their levels of planning in accordance to CAPS requirements, class practices are basically still conducted in the old way. Lessons in this regard are still dominated by teachers’ talk and chalk.

There is still a big difference as to what is said and what is practised in the classroom by the three interviewees. In terms of Case 1 the lesson observed was well presented. The planning framework of the lesson and the lesson activity presented in class was well organized. A child-centred approach was used whereby the learners dominated in the lesson. During the practical work in the classroom, learners took turns in groups to demonstrate their understanding. The material was indicated in the lesson plan in accordance with CAPS principles and it was successfully utilized in the actual lesson. Though the materials were improvised, the teacher managed to demonstrate the pedagogical knowledge during the teaching practice with the help of the experience and the knowledge acquired after obtaining a B. Ed. (hons) degree in technology education.

The teacher was compelled to demonstrate the teaching practice in an overcrowded classroom of about 60 learners. This is an indication that the teachers’ understanding of these constructs ensures effective and efficient technological practices. It also confirms the interviewees’ response from the interviews that lack of resources remains a concern in rural schools. At the end of the lesson learners were given worksheets to complete an activity individually that signified that the participant managed to reach the learning outcomes. The participant tried to utilize the method used in the new system successfully.
In terms of **Case 2**, from the lesson observed the lesson plan was well planned according to CAPS, and materials, group work and demonstrations were included. During the lesson presentation, the teacher used a teacher-centred approach. The teacher used the traditional way of teaching the learners in technology education class. Though the lesson plan was well prepared, the physical presentation failed to materialize in the actual lesson. The teacher presented the content knowledge during the teaching practice that was dominated by talk and chalk. For physical presentation, the teacher referred learners to objects such as bicycles and carengines. It was evident that the teacher used the traditional teaching method to teach technology education concepts. No group work and practical work were administered during the teaching practices.

It becomes difficult for the learners to research something that was never seen before and some of them come from disadvantaged families. It was difficult for the teacher to demonstrate the teaching practices in a populated classroom of about 68 learners. Through the experience and the knowledge the teacher acquired in ACE in technology education, it assisted the teacher in demonstrating the pedagogical knowledge during the teaching practice in technology education class.

In terms of **Case 3**, from the lesson observed, the alignment between the planning framework of lessons and the lesson activity presented in the class was confusing. Although the material was often illustrated in the lesson plan, this frequently failed to materialize in the actual lesson. Group work and self-investigation by learners were illustrated in the lesson plan but in the physical presentation of the lesson, the teachers’ presentation normally took up most of the lesson. The teacher also managed to improvise the teaching aids that were used in the classroom.

There were a manageable number of learners taught in the classroom as compared to the other two schools. The content knowledge that was demonstrated through the teaching practices was acquired through the teaching experience and the knowledge acquired through specialization in a diploma in physical science subject. The teacher used the traditional teaching method to teach technology education. Group work and project work were never used in the technology education class.

Worksheets were given out to individual learners to complete an activity. At the end learners found it difficult to complete the activity and that indicated that the lesson objectives were not successfully reached. This confirms that the teacher used the traditional teaching method
in technology education class and lack of resources also remains a concern. The teacher has a diploma in general science and used the knowledge gained from interventions to teach technology education concepts. In this situation it indicates that the teacher is unable to integrate technology concepts in the classroom practice. Lack of knowledge of the technology concepts creates a barrier for self-confidence to teach the subject.

Questionnaire responses per category

Section 2

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>As a technology teacher, were you formally trained in this specialized field?</td>
<td>20%</td>
<td>80%</td>
</tr>
<tr>
<td>Does the department of basic education provide adequate interventions to educators?</td>
<td>6.7%</td>
<td>93.3%</td>
</tr>
</tbody>
</table>

Table 4.5: Interventions provided to teachers

Section 3

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Indifferent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology teachers experience challenges in applying teaching practices in the classroom.</td>
<td>20%</td>
<td>76.7%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Teachers lack necessary insight of procedural and conceptual knowledge.</td>
<td>76.7%</td>
<td>6.6%</td>
<td>16.7</td>
</tr>
<tr>
<td>Teachers lack appropriate teaching methodology for technology as a subject</td>
<td>50%</td>
<td>50%</td>
<td>None</td>
</tr>
</tbody>
</table>

Table 4.6: Statement relating to technology practices in the classroom
4.5 RESEARCH FINDINGS

There are a number of ways in which data can be analysed (McMillan & Schumacher, 2010, p.369). Due to the observation process and the interviews being a time consuming process, fewer participants were used in the observation and interviewing process with only 3 teachers taking part in the study. The method is appropriate because it affords the researcher opportunity to explore the subject under investigation. The method is also appropriate to have in-depth data from the participants and even the participants are at liberty to give more experiences during the interviews. The questionnaires were the largest category among other research instruments and were used to triangulate data. Different participants were used in each of the data gathering methods. In both the direct observation and interviews, 3 participants were used, which accumulates to 8.3% each. Thirty participants received questionnaires, which amounts to 83.4% of the sample. The researcher sampled the three participants and accordance to how they responded to the questionnaires.

4.6 FACTORS THAT MAKE TECHNOLOGY DIFFICULT TO IMPLEMENT

The research revealed a large number of factors that contribute to the ineffective implementation of technology education concepts in schools. From the analysis, commonalities existed and as such the researcher will focus on the commonalities and all those self-standing results will be discussed separately.

Difficulty in applying teaching practices in terms of resources

During observations and interviews the researcher experience lack of sufficient resources and learning materials. Schools are not adequately resourced in terms of laboratories and learning materials. Due to financial constraints from the department of education (DoE), schools have insufficient funds to buy teaching materials and other equipment for teaching technology. This also hinders effective teaching practices and it restricts the learners’ self-learning abilities.
Lack of procedural and conceptual knowledge

The researcher experienced that some teachers struggle to teach the subject. Most of the participants are not conversant with some of technology concepts. Participants are unable to have confidence in themselves due to lack of knowledge on technology concepts. They are ill-equipped to function within the new curriculum. The question was asked to find out the teachers’ understanding of some of the concepts they are teaching. Lack of procedural and conceptual knowledge still remains a concern in most of the participants.

Lack of training interventions

Teachers are falling behind due to insufficient training by the department of basic education. CAPS made changes by means of policies but they are not supported by curriculum implementers for teacher training and development. Lack of professional training of teachers teaching technology in particular, could result in a lack of knowledge for teaching technology concepts which create a barrier for self-confidence to teach the subject.

Most of the participants obtained academic qualifications and they specialized in Biology and physical science. Among the three participants only two of them saw it necessary for them to further their studies to understand technology concepts and how it is taught. Most of the teachers still need to be developed to teach technology.

Lack of appropriate teaching methodology for technology as a subject

Technology is a new learning area with unique content which is unfamiliar to most of the teachers. The researcher found out that participants lack the necessary competencies to facilitate properly. Participants used the traditional teaching method due to the fact that they were trained in such methodologies.

Curriculum Implementers and expertise

Professional training for curriculum implementers would enhance the knowledge and skills for teachers to be effective in teaching technology education. It emerged from the findings that they struggle with some of the concepts when providing training to the teachers during interventions. Based on the findings, the following framework is suggested.
Figure 4.2: Researcher’s suggested framework.

The framework is suggested as to how technology teachers should present themselves for effective teaching practices. Generally, it is imperative for technology teachers to acquire content knowledge. Content knowledge refers to the understanding of the following dimensions (i) Subject matter knowledge, (ii) pedagogical knowledge, and (iii) experimentation/teaching. A teacher with subject matter knowledge understands the teaching practices of technology as a subject. Pedagogical knowledge refers to a teacher with a deeper understanding of the subject matter. The teacher will be able to apply methodologies and strategies as required in a technology class. A teacher who performs experiments in a class technology class involves learners in an active participation during the lesson. Design, modelling problem solving, system approaches, project planning, quality assurance and optimisation are all candidates for technological procedural knowledge. Through all these attributes, it leads the teacher to an effective teaching practice of the lesson.

4.7 SUMMARY

In this chapter, data was collected, analysed and results reported for each participant of the study. In the process of analysis, steps used such as coding and codes were discussed to ensure that there was evidence of how findings were arrived at. The results were described and explanations offered and supported with examples from the direct excerpts of the data. The findings supported by theory are discussed in the chapter that follows.
CHAPTER 5

FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5. INTRODUCTION

In this chapter the findings as a response to the research questions are discussed. In addition, the theoretical framework and the methods used to answer the research questions are reflected upon and justified for the outcomes of the study. It is also important that this chapter highlight the limitations or challenges that the researcher encountered in the process of conducting that study.

5.1 DISCUSSION OF FINDINGS

The findings in this study are reported to reflect not only the questions asked but also as a reflection of the theoretical framework employed and the methods of analysis used. It is only through a particular framework and the methods used that certain answers of a research study may be arrived at. According to McMillan and Schumacher (2010, p. 369) data can be analysed in any number of ways, and the researcher must find her own analytical style of intellectual craftsmanship. Thus the findings here are reported under the following sub-headings:

• **Teachers’ understanding of concepts in the teaching of a technology topic**

This finding is about teachers’ understanding of selected concepts in a topic they were teaching at the time of data collection. The findings are here as a portrayal of the different teachers’ understanding of concepts that were used, as they were explaining and/or using them in interpreting situations to their learners. Although teachers did not have the same understanding, only instances where concepts were used by particular teachers will be reported and excerpts related to certain teachers used as evidence of what was understood at the time of the study.

Based on the findings, it is evident that three educators had certain commonalities. It was noted that they all introduced the lessons by asking the learners questions relating to the
previous lessons. It further emerged from the findings that the participants believed that providing definitions of the technology concepts is imperative for the learners to acquire the knowledge with ease. This finding confirms what a didactic model for teaching in technology by Blomdahl and Rogal (2008) articulates, that the essence of involving the learners is to make them take responsibility for the learning and in this regard they are likely going to learn with ease. It was further noted that learners in both classes were puzzled when questions were posed at the beginning of the lessons. Of the three educators interviewed, it was noted that none of them exposed learners to practical exercises and this is because there are no funds to acquire the materials for experiments. This finding confirms what Moalosi and Molwane (2008) found, that implementation of technology education is a challenge which is evident with lack of teaching material and resources; the syllabus is detailed and as such teachers are not finishing, considering that they have just thirty minutes for the lesson. The researcher observed during the lessons that educators depend mainly on showing learners’ pictures in class, in contrast to the actual experiments, and the participants believed that learners learn best when they do hands-on activities. Despite the fact that no experiment was performed in class settings, it was generally observed that the educators were all well prepared for their respective lessons.

- **Teachers’ Application of the subject matter knowledge**

This study was mainly about the “what” and “how” of teaching technology concepts and their application. The methods and theoretical framework chosen for this study emphasize this point. That is, they emphasize the point of application of knowledge in practice. It was through observations and interviewing that it was possible to establish the links between what was understood and what was practised by the teacher.

The findings revealed that it is important to be conversant with the subject matter knowledge, particularly those who have no formal qualification in technology education. Of the three educators interviewed, they first taught technology education without appropriate qualifications. In the quest to acquire requisite knowledge, two enrolled for the technology-related qualifications. This finding is line with the model of Newsome and Lederman (1999) that for a teacher to be more effective in teaching practice, they need to develop their knowledge on the premise of the aspects as factored in the model and a sound development of the PCK. Furthermore, this revelation is in line with the theory Shulman (1986) posits that one should have knowledge on how to structure and present academic content; knowledge of
common concepts and different teachers’ experience and knowledge of teaching strategies. These essentially assist the teachers to ensure that there is effective teaching taking place. It further emerged that the department of education through the curriculum implemented are providing training to the teachers who are teaching technology education. It was however noted that the time for training is not enough for the educators to fully comprehend the content of the training. This practice exacerbates the challenges already experienced by these educators. Those educators without technology-related qualification are struggling to understand some of the concepts and as such it makes the whole teaching process a problem. Contrary to this, those educators with relevant qualifications pertaining to technology are quite comfortable and knowledgeable in terms of subject matter. It is noted that for this category of educators, their main challenge is at the end of the lesson when they are supposed to do experiments with the learners. In this instance, they tend to compromise the experiment due to the fact that no resources are available to perform such experiments.

The findings further revealed that some of the educators acquire technology knowledge through in-service and workshops, and these interventions have importantly assisted most of the educators to have a basic knowledge of technology education. This is therefore in line with what Shulman (1986) has depicted in his model in Figure 2.2.

• Teachers’ Techniques and demonstrations in the teaching practices

It was important to understand teachers’ teaching methods and techniques. No method can be used for all conceptual understanding. The teacher’s knowledge of the concepts must dictate his/her choices of methods used in different contextual situations.

Findings revealed that the teachers used question and answer method to teach the learners. The researcher observed that the teacher asked questions throughout the lesson and feedback given to the learners. It was noted that the teachers used chalkboard as a soft material to teach the learners. It emerged that the textbooks are not enough to cater for all learners and most of the time they improvise learning material to teach the learners. Using learning material to teach the learners in classroom settings, demonstrates the pedagogical knowledge of the teacher on the subject. The knowledge and skills that the teachers possess, is not properly applied.

From the survey conducted, the teachers agreed that they lack an appropriate teaching methodology for teaching technology education. This finding is contrary to the Cabrera and
La Nasa (2002) model of teaching competence, which stipulates that the instructional practice in classroom settings have a great influence on the learning process and as such the teachers must be conversant with the teaching practices. Further to this, is what Grossman (1990) advocates in the framework he developed where the third dimension thereof indicates that teacher’s knowledge of instructional strategies or methodologies for specific subjects is imminent in presenting lessons effectively. Based on this, it could therefore be deduced that the lack of instructional strategies or methodologies might be compromising effective teaching due to the fact these teachers would have no effective strategies to teach this subject effectively. Again, lack of resources further impedes the teaching because instead of embarking on practical work which is more hands on, only drawings are done, which are not sufficient for effective learning. It is thus notable that practical work ordinarily unfreezes learners from where they are held up and this stimulates and supplements the theory for better understanding of what was taught in the class. As the teacher did not do any practical work with the learners after the lesson, this suggests that the lesson was not child-centred, the lesson was not conducive to learning and therefore the teacher did not reach the lesson outcomes. This revelation is contrary to what Kolb (1984) advocated, that active experimentation should take place whereby the teacher and the learners come up with projects, where learning is occurring through practicum and encourages the learners to take a lead in the experimentation. In this regard, the teacher only acts as a facilitator and the learners are doing the practicum on their own. Evidently, the lessons as such were more teacher-centred in the sense that the teachers referred to examples of pulleys and gears at home and this is surely a traditional teaching methodology to teach a subject.

The teachers further indicated that time allocated to teach technology is not enough. Though 30 minutes is allocated, the time as such does not enable teachers to cover all the learning outcomes of specific lessons.
5.2 CONCLUSION

Based on the findings, the following conclusions are drawn as they emerged from the main three themes. PCK can be described as how teachers teach their subject by accessing what they know and about the subject, the learners they are teaching and the curriculum with which they are working from (Rolinick, Bennett, Rhemtula,Dharsey&Ndlovu, 2008, p.1367).

- **Teachers’ understanding of concepts in the teaching of a technology topic**

As regards to this theme, it can be concluded that teachers were versed in the concepts of teaching technology education. This was evident by the manner in which they introduced the lessons to the learners in class. It was noted that none of the teachers conducted practical work in the class and this is crucial for learners to get a better understanding of the subject matter. All teachers attest that learners learn best when they are involved doing hands-on activities which is lacking in this regard.

- **Teachers’ application of the subject matter knowledge**

From the findings, it could be concluded that of the three teachers interviewed, two had formal qualification in technology and this essentially means that they have thorough subject knowledge. The possession of relevant subject knowledge, namely technology, enhances the teachers’ self-efficacy and as such they tend to perform well in the teaching of this subject. It could further be concluded that the department of basic education offers in-service training; however, teachers posit that training time is not enough, hence teachers who only learned technology through in-service, struggle to teach the subject. It is noted that though teachers are able to teach the subject, conducting practical work is still a challenge since most of them indicated that they do not have teaching aids to conduct the practical work.

- **Teachers’ techniques and demonstrations in the teaching practices**

As regards to the above theme, it emerged that all the teachers used the question and answer method, which is a common method used in schools. It was further concluded that there is a shortage of text books and other teaching aids such as materials that could be used to perform practical work. This factor is believed to be a barrier to effective teaching of technology. Based on this aspect, the teachers are able to teach, but their subject matter is not fully
applied due to the fact that no experiments were done. It was further noted that some of the
teachers lack appropriate teaching methodology to teach technology education and this could
result in teachers lacking self-confidence in teaching the subject, which will ultimately
compromise teaching. It could further be concluded that the lessons presented were more
teacher-centred. This is however, contrary to best teaching practices if one has to get
outcome-based results. Finally, it is notable that teachers raised a concern that the time
allocated for technology is not adequate and this is as result that a period of 30 minutes is
allocated.

5.3 LIMITATIONS AND IMPLICATIONS OF THE STUDY

Every study has its own limitations and this specific study is not an exception. Several
limitations were identified. (i) The researcher interviewed technology education teachers
teaching grade 9 classes. The limitation of the study is that other teachers in the school who
were not interviewed might not know or understand the teaching practices implemented in
technology education class.(ii) Most of the teachers were not trained to teach the subject as a
result they preferred to use traditional teaching method. (iii) All schools do not have
laboratories to perform practical work. Practical work was done in classes.(iv) Only one
teacher did practical work with the learners. The learners enjoyed the lesson as they were
actively involved in the lesson. (v) The other two teachers did not perform any practical work
with the learners due to the fact that they lack the procedural and conceptual knowledge of
the subject matter. (vi) Technology was taught by teachers with no specialisation in the
subject. Teachers were edged to implement the technology education without the relevant
qualifications hence they are experiencing challenges in teaching the subject. (vii) Shortage of
textbooks is a concern to all the three schools. Most teachers lack appropriate teaching
methodology for teaching the subject. (viii) The other concern with teachers is lack of
interventions and workshops to enrich them with the content as well as the duration for
teaching the subject. (ix) Teachers further their studies on their own so that they can have an
understanding of the subject matter. As the study was voluntary, those who did not participate
could have perhaps provided a different perspective on the study.
5.4 RECOMMENDATIONS

Given the challenges identified in the study and also based on the conclusions drawn, this section will provide recommendations on how the offering of technology could be improved. According to Newsome and Lederman (1999, p.95) teachers with differentiated and integrated knowledge will have greater ability than those whose knowledge is limited and enact lessons that help learners develop deep and integrated understanding. In this regard, the following recommendations are suggested:

- It is recommended that teachers with formal technology education be allocated to teach technology education. This would ensure that the teachers exert themselves well on the subject as they are properly trained on the pedagogical knowledge of the subject. By doing so, this would enhance quality teaching.

- It is further suggested that the practical work be conducted as a way to unfreeze the learners and this could enhance effective learning.

- Teachers who are interested in teaching technology should be afforded the opportunity to enrol for technology qualifications, such as a postgraduate diploma in technology education. Providing formal training would ensure that teachers would understand the subject matter much better, compared to a workshop.

- It is suggested that teachers should be more interactive in their lessons and avoid being teacher-centred. This approach limits learner participation and with recent teaching strategies, learners should play a major role in their learning.

- Teachers should be provided with learning aids for practical work.

- As technology education is more practical, it is suggested that the period be allocated more time to ensure that the work plan is completed.
5.5 REFERENCES


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ANNEXURE A: INFORMED CONSENT

Project title: Technology education teachers’ teaching practices in the South African schools’ curriculum

Investigator: Ms PMA Moeletsi

Dear participant,

You are invited to participate in a research study that investigates teaching practices implemented by teachers teaching technology education. The information in the consent form will assist you to decide if you would like to participate. Before you agree to take part, you should understand what is involved.

PURPOSE OF THE STUDY

The purpose of the study is to investigate the teaching practices implemented by teachers in offering technology education in schools and to determine how teaching practices are developed in such a way that learners are able to achieve the learning outcomes. Your participation in this study is important so as to understand the current teaching practices and the challenges encountered in offering the subject.

YOUR RIGHTS AS A PARTICIPANT IN THIS STUDY

Your participation in this study is absolutely voluntary. Should you decide to participate, you may withdraw at any given time without providing a reason for your decision.

CONFIDENTIALITY AND ANONYMITY

All information gathered during the course of this study is strictly confidential. The study data will be coded so that it will not be linked to your name. No personal identifiers will be revealed while the study is being conducted. The information obtained during the research will only be used for research purposes.

CONTACT FOR ADDITIONAL INFORMATION REGARDING THE STUDY

Should you require further information regarding the study, you can contact the supervisor Dr TDT Sedumedi at 012 382 9484/ 0842062159.

YOUR PARTICIPATION IN THIS STUDY WILL BE HIGHLY APPRECIATED
ANNEXURE B: RESEARCH LETTER TO REQUEST PERMISSION

Tshwane University of Technology
Department of Maths, Science and Technology Education
Soshanguve North Campus
Soshanguve
0151

Nkangala District Department of Education
Private Bag X4021
Kwa-Mhlanga
1022

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

In order to satisfy the requirements of the Master’s Degree in Technology (M. Ed: Technology Education) at Tshwane University of Technology, it is imperative to embark on a research project which means that as a postgraduate student I need to collect data in the identified sites. The focus of the study is on the teaching practices as implemented by teachers in the classroom settings when teaching technology education. The title of the research project is, “Technology education teachers’ teaching practices in the South African school curriculum: a multiple case study”

In the context of the above, I am therefore requesting permission to conduct research at the following middle schools, namely, Dikotelo, Mapala and Madikole Middle Schools. I am currently employed as an educator under the auspices of Mmametlhake Circuit office. The selected teachers will take part on voluntary basis. I can assure you that all information gathered will be treated as confidential and no personal identifiers will be used during data
collection. The dates for the research are not yet decided; schools will only be informed after the permission has been granted.

If so requested, a copy of the dissertation may be forwarded to you. Should you require any additional information, do not hesitate to contact me on +27 72 877 6597 or e-mail at percinah@gmail.com. Further information may be obtained from my research supervisor, Dr TDT Sedumedi at (012) 382 9484 or 0842062159.

Your approval would be highly appreciated.

Yours faithfully

PMA Moeletsi (Student)
Dear Madam

RE: REQUEST TO CONDUCT RESEARCH WITHIN NKANGALA DISTRICT

1. Your application with regard to the above subject has reference.
2. Permission is granted for you to conduct a research as requested.
3. You are, however, requested to make prior arrangements with school principals before you visit the school.
4. You are also requested not to disturb the academic programme of the schools you will be visiting.
5. The Department of Education wishes you a successful research and completion of your qualification.

Yours Faithfully

[Signature]

MR. JJ MABENA
DISTRICT DIRECTOR

Siseko Sifunziisa Sive

DATE: 20/04/02

1

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Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

In order to satisfy the requirements of the Masters Degree in Technology (M. Ed: Technology Education) at Tshwane University of Technology, it is imperative to embark on research project which means that as a postgraduate student I need to collect data at your school. The research will take place somewhere around July 2013. Find a copy of approval letter from the District Office attached at the back of this letter.

Should you require any additional information, do not hesitate to contact me on +27 72 877 6597 or e-mail at percinah@gmail.com. Further information may be obtained from my Research supervisor, Dr TDT Sedumedi at (012) 382 9484 or 0842062159.

Your approval would be highly appreciated.

Yours faithfully

Moeletsi PMA (student)
Dear Madam

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5. The Department of Education wishes you a successful research and completion of your qualification.

Yours Faithfully

MR. JJ MABENA
DISTRICT DIRECTOR

20/3-04-02

Education
DEPARTMENT OF EDUCATION
MPUMALANGA
NKANGALA DISTRICT

OFFICE OF THE DISTRICT DIRECTOR

Ref No: 131
Enq: S M Kabini
Email: s.kabini@education.mpu.gov.za

MS PMA MOLETSI
P O BOX 2269
RENTOWN
HAMMANSKRAA
0400
02 APRIL 2013
The Principal
Mapala Primary School
Nokaneng Circuit
0412

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

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Moeletsi PMA (student)
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P O BOX 2269  
RENTOWN  
HAMMANSKRAA  
0400  
02 APRIL 2013  

Dear Madam  

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5. The Department of Education wishes you a successful research and completion of your qualification.  

Yours Faithfully  

MR. JJ MABENA  
DISTRICT DIRECTOR  

20/3-04-02  

DATE  

MPUMALANGA
The Principal
Madikole Primary School
Nokaneng Circuit
0412

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

In order to satisfy the requirements of the Masters Degree in Technology (M. Ed: Technology Education) at Tshwane University of Technology, it is imperative to embark on research project which means that as a postgraduate student I need to collect data at your school. The research will take place somewhere around July 2013. Find a copy of approval letter from the District Office attached at the back of this letter.

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Your approval would be highly appreciated.

Yours faithfully

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Dear Madam

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4. You are also requested not to disturb the academic programme of the schools you will be visiting.
5. The Department of Education wishes you a successful research and completion of your qualification.

Yours Faithfully

MR. JJ MABENA
DISTRICT DIRECTOR

MPUMALANGA
A Pioneering Spirit

Sisomko Shandzisa Sive
### ANNEXURE E: OBSERVATION TOOL FIELD NOTES

**OBSERVATION TOOL COVER PAGE**

#### GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Name of school</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Topic</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
</tr>
<tr>
<td>Classroom/ Laboratory</td>
<td></td>
</tr>
<tr>
<td>Size of a classroom</td>
<td></td>
</tr>
<tr>
<td>Number of learners</td>
<td></td>
</tr>
<tr>
<td>The main teaching activity</td>
<td>Comments</td>
</tr>
</tbody>
</table>

#### The teacher

<table>
<thead>
<tr>
<th>Involve learners actively</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Use appropriate variety of teaching techniques</td>
<td></td>
</tr>
<tr>
<td>Use appropriate variety of teaching methods</td>
<td></td>
</tr>
<tr>
<td>Use appropriate teaching resources</td>
<td></td>
</tr>
<tr>
<td>Perform practical demonstrations</td>
<td></td>
</tr>
<tr>
<td>Use assessment to help learners</td>
<td></td>
</tr>
<tr>
<td>Give feedback to learners</td>
<td></td>
</tr>
<tr>
<td>Show good subject knowledge to regarding PCK</td>
<td></td>
</tr>
<tr>
<td>The main teaching activity</td>
<td>Comments</td>
</tr>
</tbody>
</table>

#### The learner

<p>| Think of themselves and ask appropriate questions |  |
| Use discussion to deepen understanding |  |
| Actively performs practical demonstrations |  |</p>
<table>
<thead>
<tr>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate actively in the entire lesson</td>
</tr>
<tr>
<td>Show an understanding of PCK</td>
</tr>
</tbody>
</table>
ANNEXURE F: RESEARCH INSTRUMENT

Questionnaires (Open)

Title: Technology Education Teachers’ Teaching Practices in the South African Schools Curriculum: A Multiple Case Study

Investigator: Ms PMA Moeletsi

The purpose of the study is to investigate the teaching practices implemented by teachers in offering technology education in schools and to determine how teaching practices are developed in such a way that learners are able to achieve the learning outcomes. Your participation in this study is important so as to understand the current teaching practices and the challenges encountered.

This questionnaire consists of three sections; section 1: biographical information, section 2: interventions provided to teachers and section 3: technology practices in classroom.

Kindly try to answer all questions to the best of your ability and as objectively as possible.

Section 1: Biographical information

<table>
<thead>
<tr>
<th>Province</th>
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<tbody>
<tr>
<td>Name of the school</td>
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<tr>
<td>Circuit</td>
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<tr>
<td>Date</td>
<td></td>
</tr>
</tbody>
</table>
**Section 2: Interventions provided to teachers**

<table>
<thead>
<tr>
<th>No.</th>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>As technology education teacher, where you formally trained in this specialized field?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Are you conversant with the knowledge and skills applied in technology education?</td>
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</tr>
<tr>
<td>3</td>
<td>Are you content with technology concepts applied in the classroom setting?</td>
<td></td>
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<tr>
<td>4</td>
<td>Does the department of education provide adequate interventions to educators?</td>
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<td></td>
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<tr>
<td>5</td>
<td>Does the department supply enough resources for teaching technology education?</td>
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</tr>
<tr>
<td>6</td>
<td>Do curriculum implementers and subject coordinators have knowledge about the subject?</td>
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</tbody>
</table>

**General comment**

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Section 3: Statements relating to technology practices in classroom

<table>
<thead>
<tr>
<th>No</th>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Indifferent</th>
<th>Strongly disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technology teachers experience challenges in applying teaching practices in the classroom.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Teachers integrate technology concepts in the classroom.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Teachers lack necessary insight of procedural and conceptual knowledge.</td>
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<tr>
<td>4</td>
<td>Teachers lack appropriate teaching methodology for technology education.</td>
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<tr>
<td>5</td>
<td>The specific objectives of some modules are difficult to understand.</td>
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<tr>
<td>6</td>
<td>Teachers need to be developed to be technology literate.</td>
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</tbody>
</table>

School stamp
ANNEXURE G: INTERVIEW SCHEDULE

1. Define the term Technology?
2. What is teachers’ understanding of selected technology concepts?
3. 
   **Probing questions**
   - Are you confident enough when teaching the subject?
   - Explain terminology concepts related to your lesson.
   - Indicate the examples of technology education activities in your classroom.
4. How do teachers teach particular technology education concepts to be easily understood by learners?
   **Probing questions**
   - Which method is appropriate for teaching technology education concepts and why?
   - Do you usually reach the outcomes at the end of your lesson?
5. What knowledge and skills do you have regarding the teaching practices?
   **Probing questions**
   - Have you been trained for teaching technology education before as a profession?
   - During the interventions with the curriculum implementers do they usually provide you with both content knowledge and practical work? What actually happens during interventions?
6. How do you approach the challenges you encounter when applying technology education?
   **Probing questions**
   - According to the challenges that have been encountered, are you able to integrate technology concepts in the classroom practice?
   - Are learners able to come up with their own initiative and solutions?
   - Are learners given opportunity to develop their own design and models?
   - Does your school have a special place where you can perform practical work with the learners, i.e. laboratories or workshops?
   - Does the government provide schools with enough teaching and study materials?
   - Do you understand the specific objectives of all the modules relating to technology concepts?