Impediments faced by Technology teachers in the teaching of Technology

by

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ABSTRACT

This study focused on the impediments that are faced by technology teachers and that hinder the effective teaching of Technology in Nkangala Sub-District schools.

For teachers to be effective in the teaching of Technology, it is imperative for them to undergo training on the content and pedagogy. Professional development is the development of teachers' knowledge and skills through training programmes to enable them to teach effectively and also assist in content enrichment throughout the teaching experience. Teachers had to be trained and/or retrained in the implementation of Technology Education by means of workshops organised by the Department of Basic Education in each of the nine provinces in order to understand the vision of the subject. Through the training, teachers will acquire subject matter knowledge in context. Technology teachers should also have technological knowledge, which refers to the teachers' knowledge of activities and concepts relating to the body of content.

In the context of the above, Technology Education requires a teacher to be well versed in curriculum content as well as appropriate teaching practices. It is important to understand where there are consistencies in teaching practices and what takes place in the classroom. When Technology Education was introduced, most teachers were expected to use technology in schools without being adequately trained on the content or even in teaching methodologies. Although various interventions have been made since the implementation of Technology as a subject, there seems to be a lack of appropriate teaching practices, which could be one of the impediments to teaching Technology. This could result in a situation where teachers have to teach certain concepts without the necessary knowledge and/or self-confidence to teach topics. In the implementation process, many of the impediments encountered were created by factors such as a lack of funds in the rural area schools and inadequate training of Technology Education teachers.

The aim of the study was therefore to understand the nature of impediments that Grades 8 – 9 teachers of Technology face in the Nkangala Sub-District of Mpumalanga. A qualitative approach was used and twelve teachers participated in the study. It emerged from the findings that teachers are affected by the absence of curriculum implementers in the whole Nkangala Sub-District. Of the twelve teachers interviewed, it was noted that only four taught Technology

with appropriate qualifications. The researcher observed during the lessons that teachers depended mainly on chalk-and-board by drawing pictures rather than engaging learners in practical activities, and this was because there were no funds to acquire the materials for experiments. The participants believed that learners learn best when they do hands-on activities. Very important to note is that those teachers without Technology-related qualifications struggled to understand some of the concepts, which made the whole teaching process problematic.

The findings reveal that the teachers used the question-and-answer method to teach the learners. It was observed that they asked questions throughout the lesson and gave feedback to the learners. Teachers agreed that they lacked subject matter knowledge and an appropriate teaching methodology for teaching Technology. This means that teaching might be compromised since these teachers would have no effective strategies to teach the subject effectively. It can be concluded that there are impediments facing teachers in their teaching practices. This is characterised by a lack of subject knowledge and resources and an inadequate methodological approach to teaching Technology.

Keywords: Impediments, Technology, Technology teachers, teaching, pedagogical content knowledge, curriculum

TSHOBOKANYO

Thutopatlisiso e ne e totile dikgoreletsi tse barutabana ba thekenoloji ba lebaneng natso tse e bile di kgoreletsang go ruta go go siameng ga Thekenoloji kwa dikolong tsa Kgaolopotlana ya Nkangala.

Gore barutabana ba nne le bokgoni jwa go ruta Thekenoloji, go botlhokwa gore ba katisiwe ka serutwa le go se ruta. Tlhabololo ya seporofešenale ke go godisiwa ga kitso le dikgono tsa barutabana ka mananeo a katiso go ba kgontsha go ruta ka bokgoni le go ba thusa go humisa dithuto fa ba ruta. Barutabana ba tshwanetse go katisiwa le/gongwe go katisiwa gape malebana le go diragatsa Thuto ya Thekenoloji ka tsela ya dikopanothutano tse di rulagantsweng ke Lefapha la Thuto ya Motheo kwa diporofenseng tsotlhe tse robongwe gore ba tlhaloganye ponelopele ya serutwa. Ka katiso, barutabana ba tlaa nna le kitso ya serutwa ka botlalo. Gape barutabana ba thekenoloji ba tshwanetse go nna le kitso ya thekenoloji, e leng se se kayang kitso ya morutabana ya dintlha tsotlhe tse di amanang le serutwa seo.

Malebana le se se kailweng fa godimo, Thuto ya Thekenoloji e tlhoka gore morutabana a tlhaloganye lenaneothuto ka botlalo gammogo le ditiragatso tsotlhe tse di maleba tsa go ruta. Go botlhokwa go tlhaloganya moo go nang le go tlhoka go tshwana mo tseleng ya go ruta le gore go diragalang mo phaposiborutelong. Fa go ne go itsisiwe Thuto ya Thekenoloji, go ne go lebeletswe gore bontsi jwa barutabana ba dirise thekenoloji kwa dikolong kwa ntle ga katiso epe ya serutwa gongwe le fa e le mekgwa ya go ruta. Le fa go nnile le ditsereganyo di le mmalwa fa e sale tsenyotirisong ya Thekenoloji jaaka serutwa, go bonala go na le tlhaelo ya ditsela tse di maleba tsa go ruta, se e ka nnang nngwe ya dikgoreletsi tsa go ruta Thekenoloji. Seno se ka baka seemo se mo go sona barutabana ba tshwanelang go ruta dithuto dingwe kwa ntle ga kitso e e tlhokegang le/gongwe go itshepa go ruta ditlhogo tse di rileng. Mo tiregong ya tsenyotirisong, bontsi jwa dikgoreletsi tse go kopanweng natso di ne di bakilwe ke dintlha di tshwana le tlhaelo ya matlole kwa dikolong tsa metsemagae le katiso e e sa lekanang ya barutabana ba Thuto ya Thekenoloji.

Ka jalo, maikaelelo a thutopatlisiso e ne e le go tlhotlhomisa dikgoreletsi tse di lebaneng barutabana ba Thekenoloji ba Mephato ya 8-9 kwa dikolong tsa Kgaolopotlana ya Nkangala kwa Mpumalanga. Go dirisitswe molebo o o lebelelang mabaka mme barutabana ba le masomepedi ba nnile le seabe mo thutopatlisisong. Go tlhageletse go tswa mo diphitlhelelong

gore barutabana ba amiwa ke go tlhokega ga batsenyatirisong ba lenaneothuto mo Kgaolopotlaneng yotlhe ya Nkangala. Mo barutabaneng ba le lesomepedi ba ba botsoloditsweng dipotso, go lemogilwe gore ke ba le bane fela ba ba rutang Thekenoloji ka borutegi jo bo maleba. Mmatlisisi o lemogile gore ka nako ya dithuto barutabana ba ne ba ikaegile thata mo tšhokobotong ka go thadisa ditshwantsho go na le go dira gore barutwana ba diragatse ditirwana, mme seno ke ka ntlha gore go ne go se na matlole a go bona dimatheriale tsa go dira ditekeletso. Bannileseabe ba ne ba dumela gore barutwana ba ithuta botoka fa ba dira ditirwana ka bo bona. Ntlha ya botlhokwa e e tshwanetseng go elwa tlhoko ke ya gore go ne go se bonolo gore barutabana ba ba neng ba se na borutegi jwa Thekenoloji ba tlhaloganye dintlha dingwe, e leng sengwe se se neng se dira gore tirego yotlhe ya go ruta e nne le mathata.

Diphitlhelelo di bontsha gore barutabana ba tlwaetse mokgwa wa go botsa dipotso le go bona dikarabo go ruta barutwana. Go lemogilwe gore ba ne ba botsa dipotso mo thutong yotlhe mme ba tsibogela dikarabo tsa barutwana. Barutabana ba dumelane gore ba tlhaela kitso ya serutwa le mokgwathuto o o maleba wa go ruta Thekenoloji. Seno se raya gore go ruta go ka tlhaela ka ntlha ya gore barutabana bano ga ba na ditogamaano tse di siameng tsa go ruta serutwa ka bokgoni. Go ka swediwa gore go na le dikgoreletsi tse di lebaneng barutabana mo go ruteng ga bona. Seno se lemogwa ka ntlha ya tlhaelo ya kitso ya serutwa le ditlamelo gammogo le molebo o o sa lekanang wa mokgwathuto wa go ruta Thekenoloji.

Mafoko a botlhokwa: Dikgoreletsi, Thekenoloji, barutabana ba Thekenoloji, go ruta, kitso ya go ruta serutwa, lenaneothuto

KAKARETŠO

Dinyakišišo tše di lebantše go mapheko ao a barutiši ba theknolotši ba lebanago nao gape e le ao a thibelago go rutwa gabotse ga Theknolotši ka dikolong tša Selete se se Nyane sa Nkangala.

Gore barutiši ba šome botse mo go ruteng Theknolotši, go bohlokwa go bona gore ba hlahliwe ka dikagare le thuto (phedakotši). Tlhabollo ya seprofešenale ke tlhabollo ya tsebo le mabokgoni a barutiši ka mananeo a tlhahlo go ba kgontšha go ruta ga botse gape le go thuša go matlafatša dikagare mo boitemogelong ka moka bja go ruta. Barutiši ba ile ba swanela go hlahliwa le/goba go hlahliwa leboelela mo phethagatšong ya Thuto ya Theknolotši ka go šomiša diwekešopo tša go beakanywa ke Kgoro ya Thuto ya Motheo ka go ye nngwe le ye nngwe ya diprofense tše senyane go kwešiša morero ya thuto. Ka tlhahlo, barutiši ba tla hwetša tsebo ya dikagare tša thuto go ya ka seemo. Gape barutiši ba theknolotši ba swanela go ba le tsebo ya theknolotši, yeo e šupago tsebo ya barutiši ya mešongwana le dikgopolo tša go amana le mmele wa dikagare.

Mo seemong sa ka godimo, Thuto ya Theknolotši e nyaka morutiši gore a tsebe ka botlalo dikagare tša kharikhulamo le mekgwa ya maleba ya go ruta. Go bohlokwa go kwešiša fao go nago le diphegelelo ka gare ga mekgwa ya go ruta le seo se diregago ka gare ga diphapošiborutelo. Ge Thuto ya Theknolotši e be e thoma go rutwa, bontši bja barutiši bo be bo letetšwe gore bo šomiše theknolotši ka dikolong le ge ba se ba hlahliwa ka mo go lekanego mabapi le dikagare goba le yona mekgwa ya go ruta. Le ge magato a go fapana a tseno bogare a dirilwe go tloga go phethagatšo ya Theknolotši bjalo ka thuto, go bonala go na le tlhokego ya mekgwa ya go ruta ya maleba, yeo e kago ba ye mengwe ya mapheko a go ruta Theknolotši.

Bjalo maikemišetšo a dinyakišišo e be e le go kwešiša mapheko a barutiši ba Dikreiti 8 - 9 ba Thuto ya Theknolotši ba lebanago ka dikolong tša Selete se se Nyane sa Nkangala sa Mpumalanga. Mokgwa wa khwalithethifi o šomišitšwe gomme barutiši ba lesomepedi ba kgathile tema ka dinyakišišong. Dikutullo di tšweletša gore barutiši ba amilwe ke tlhokego ya baphethagatši ba kharikhulamo ka Seleteng se se Nyane sa Nkangala ka moka. Go barutiši ba lesomepedi ba go boledišanwego le bona, go lemogilwe gore ke ba bane fela bao ba bego ba ruta Theknolotši ka mangwalo a thuto a maleba. Monyakišiši o bone gore nakong ya dithutišo barutiši ba be ba tshephile kudu letlapa le tšhoko ka go thala diswantšho sebakeng sa go ba boledišana le baithuti ka mešongwana ya tirišo, gomme se ke ka lebaka la gore go be go sena

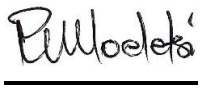
tšhelete tša go reka dimetheriale tša go dira maitekelo. Bakgathatema ba be ba dumela gore baithuti ba ithuta bokaone ge ba dira mešongwana ka diatla tša bona. Go bohlokwa kudu go lemoga gore barutiši bao ba go hloka mangwalo a thuto a go amana le Theknolotši ba gogile boima go kwešiša tše dingwe tša dikgopolo, tšeo di dirilego gore tshepedišo ka moka ya go ruta e be le mathata.

Dikutullo di utulla gore barutiši ba šomišitše mokgwa wa potšišo le karabo go ruta baithuti. Go bonwe gore ba botšiša dipotšišo nako ka moka ya thutišo gape ba file baithuti karabo. Barutiši ba dumetše gore ba be ba se na tsebo ya dikagare tša thuto le mokgwa wa maleba wa go ruta Theknolotši. Se se ra gore go ruta go ka ba le bofokodi ka ge barutiši ba tlo ba ba sena maano a mabotse a go ruta thuto ka tshwanelo. Go fetšwa ka gore go na le mapheko ao a barutiši ba lebanago nao mo mošomong wa bona wa go ruta. Se se dirwa ke tlhokego ya tsebo ya thuto le methopo le mokgwa wa go se lekane wa go ruta Theknolotši.

Mantšu a bohlokwa: Mapheko, Theknolotši, barutiši ba Theknolotši, go ruta, tsebo ya dikagare tša thuto (phedakotši), kharikhulamo

DECLARARION BY CANDIDATE

I, Percinah Maseabe Annah Moeletsi, declare that "**Impediments faced by technology teachers in the teaching of Technology"** is my own work, except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Doctorate at the University of South Africa (UNISA), Pretoria. Furthermore, I declare that this Research Report, has not been submitted before for any degree or examination to this or any other university.



PMA Moeletsi Date: February 2022

DEDICATION

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

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My mentor for his continuous support, resounding encouragement for me to pursue Technology Education, and motivation which led to the completion of the study.

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CHAPTER 1

ORIENTATION OF THE STUDY

1.1 INTRODUCTION

Technology Education has been in existence for over half a century (Mapotse, 2017:687). In South Africa, the Technology subject was introduced as a relative newcomer since the inception of Curriculum 2005 (C2005) (Khumalo, 2004 in Makgato, 2014:3688). In addition, Gumbo (2003), Kalanda (2005), Maluleka, Wilkinson and Gumbo (2006), Mapotse and Gumbo (2013) and Stevens (2005) in Gumbo (2016) also assert that Technology Education as a subject is a relative newcomer to the school curriculum. According to Makgatho (2013:3687), Technology is part of the curriculum at schools and starts from Grades 8 – 9 in the Senior Phase as one of the subjects. The inception of Technology Education as a subject in schools aroused fast-tracked training for teachers as part of their initial and continuous professional development (Gumbo, Makgato & Muller, 2012:24) as there had to be a supply of teachers to roll out the subject. Professional development is the development of teachers' knowledge and skills through training programmes to enable them to teach effectively.

The terms Technology and Technology Education will often be used interchangeably throughout the study, meaning the same subject. Numerous Technology Education programmes and strategies have been developed globally to ensure that Technology as a subject is used effectively for the benefit of learners' learning and achievement. Aldridge, Berry and Ntuli (2009:147) attest those professional programmes have been developed to enable teachers to be engaged in in-service teacher training at a distance. Raucher (2010) in Mapotse (2012:2), argues that the introduction of Technology Education globally has posed many impediments to those experienced in other subjects. Applied to this study, the term *impediments* refer to the obstacles that make Technology Education difficult for teachers to implement effectively.

The long-term developmental processes which require teachers to focus on changing their own practices of learning new roles and ways of teaching are also required by the educational reform (Dichaba & Mokhele, 2012:249). This proved to be a dire need for the implementation of Technology Education due to its uniqueness compared to other subjects. According to Sedio (2013:1), the implementation of Technology Education in schools expected teachers to refocus

on a refined understanding of the subject, the general use of resources and materials to support its implementation, and new planning methods and assessment. The implementation of Technology Education is aimed at developing the teachers' technological understanding of the subject. Teachers had to be trained and/or retrained for the implementation of Technology Education in workshops to acquire the vision of the subject organised by the Department of Education in each of the nine provinces.

Locally, Technology became a priority as a new subject since the implementation of C2005 (Makgato, 2014; Gumbo, 2003; 2014). Due to the limited time frame for the implementation, there was little time to train teachers earmarked to teach Technology. Gumbo, Makgato and Muller (2012:25) attest that the training workshops for teachers have been held during school holidays and on Saturdays. According to Pithouse (2001) in Makgato (2014:3689), short workshops were not the best way to promote long-term teaching practice and due to limited time, teachers did not get enough opportunity to study and reflect on this new information. Engelbrecht, Ankiewickz & De Swardt (2007:583) agree with other authors that curriculum implementers or subject advisors gathered teachers from different schools at a central venue for training courses or workshops for a day or longer. Sedio (2013:3) criticises the fact that subject specialists trained teachers at workshops whereas they themselves did not possess an in-depth understanding of Technology content knowledge (CK) and pedagogy. The researcher is of the opinion that subject advisors themselves may lack an understanding of training Technology teachers and how to manage it effectively.

During the implementation of (C2005 in 1998, most teachers were expected to use and teach Technology in schools without being adequately trained (Gumbo *et al*., 2012; Mapotse & Gumbo, 2013 in Gumbo, 2016:2). Aneas (2015:1715) reveals that many teachers lack experience in the respective themes of Technology which results in one of the impediments that affect the successful implementation of the subject. Nokwali, Mammen, and Maphosa (2014:465) state that curriculum changes in the area of Technology are a challenge to the majority of unqualified teachers to teach the subject. The biggest shortage in Technology Education experienced by teachers is always that of resources.

Technology Education deals in conjunction with values, diverse collection of processes, skills and knowledge that people use to extend human abilities. According to Nokwali *et al.*, (2014:464), Technology Education is a subject that has its own values. The important concepts

of Technology that deal with thinking skills are problem solving values, attitudes, reasoning, critical thinking, analytical skills, positive attitudes, creative thinking and innovative thinking skills. Technology, therefore, needs teachers who are technologically literate and who understand its importance of adding value on both the learners and the community. Nokwali *et al.,* (2014:465) attest to the manner in which Technology is formulated, i.e., to assist and develop the learners' thinking skills to operate effectively in the world they live in. Makgato (2014:3689) argues that a clear understanding of Technology teaching should start with what learners should learn and be taught. Makgato (2014:3689) argues that facilitators of the Revised National Curriculum Statement (RNCS) training courses still lack knowledge and skills to facilitate the teaching of Technology properly, hence, the teachers received inadequate and poor training during the workshops. The poor training courses of Technology created a barrier for self-confidence on the teachers and caused their being ill-equipped to function within the new curriculum. In addition, it is clear that for Technology teachers not to be fully equipped to function w Technology is the fact that facilitators are not adequately trained for the training courses, which adds to the impediments for effective teaching of the subject. In ensuring that teachers are effective in teaching Technology Education, they need to be well acquainted with the knowledge of Technology as a concept. The impediments experienced by Technology teachers are thus the main focus of this study.

Technology teachers are faced with many impediments in implementing Technology Education inside and outside the classroom. Even though Technology Education was initiated after the democratic government in 1994 as a subject in South African schools, there has been many debates confirming that the majority of teachers are still struggling with both and a deep understanding of the subject matter (Mapotse, 2018:686). Although Technology Education was implemented long ago in South African schools' curricula this change has not been applauded at all. On this note, the researcher deems it being imperative to explore the impediments of Grades 8 – 9 Technology teachers as they apply to their lack of or understanding of the subject and its pedagogical strategies, i.e., to understand Technology teachers' difficulties created by external and internal impediments on their teaching practice.

In the context of the above, for effective implementation of Technology Education, it is imperative for teachers to be well experienced with the curriculum content as well as the appropriate teaching practices (Engelbrecht, Ankiewicz & De Swardt, 2007:580). Angelbrecht *et al.,* (2007:580) concur that most teachers were expected to implement Technology Education

in schools without being well trained in the content and teaching methodologies. The above situation is one of the impediments that could result in a situation where teachers have to teach certain concepts without the necessary experience and/or knowledge about the Technology Education topics. To add, since the introduction of Technology Education in schools, teachers still experience challenges with the proper implementation of the subject itself especially in rural schools. But this is caused by lack of qualified teachers, particularly in rural areas where many teachers are underqualified (Aldridge, 2009:147). Hence, this study targets rural schools where the implied impediments are very much conspicuous. Such schools, the researcher supposes, need attention more than those in urban environments. The implied contexts are Mmametlhake, Marapyane and Libangeni circuits in Nkangala Sub-District. The researcher is keen to understand as to how Technology teachers experience and grapple with these impediments in that context. Furthermore, the researcher's understanding can be illuminated by the kind of impediments that these teachers come across internally and externally?

1.2 BACKGROUND AND RATIONALE

According to Gumbo (2018:128), ever since Technology Education was introduced as part of the curriculum transformation in 2005 which was implemented in South African schools in 1998, it is still misunderstood both internally and externally. Ever since the inception of Technology Education in 1998, 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 (Gumbo, 2018:128). Mapotse (2017:3) attests that even though Technology Education is older than the new democracy, lots of articles confirm that numerous teachers are still incompetent to teach Technology properly with both the CK and the pedagogical knowledge (PK) of the subject. Unfortunately, during this first implementation, C2005, the NCS and then the RNCS were unsuccessful (Department of Basic Education, 2009:9). It was expected that the implementation of the curriculum would bring change in the way Technology teachers would teach and the way learners would learn. According to the researcher, it was not expected that at this time there will still be opinions of what Technology should be, how learners should learn and what are the effective teaching strategies in teaching the subject. The curriculum change process was accompanied by factors such as stress, fear, resistance, demotivation and disempowerment which proved to be harmful to the successful implementation of Technology Education as a subject.

Although many teachers' qualifications in the country have improved, the majority of teachers have not been sufficiently equipped to meet the changing educational needs of the society (Gumbo *et al*., 2012:23). Makgato (2014:3689) discovered that during the former Outcomes-based-education (OBE) training courses, the facilitators did not get enough training in the teaching and learning of Technology as a subject. They also did not possess adequate Technology CK and skills to present these workshops, hence the teachers received insufficient and poor-quality training in the Technology subject. Mapotse (2015:213) discovered how action research has had the power to change and providing design and educational instruments that contributed to teachers with no formal training to teach Technology Education in schools as a subject. A lot of Technology Education training programmes were developed and are tried to be applied with great excitement, but unfortunately the impediments related to Technology Education were not solved completely (Ozden, 2007:157). Amongst the reasons that can be given, is that the curriculum implementers had insufficient training to workshop Technology teachers (Makgato 2014:3689). The training workshops were not enough for teaching and learning and therefore implementation brought challenges for Technology teachers. According to Mapotse (2017:3), the impediments that contributed to the ineffective teaching of Technology are a majority of unqualified or underqualified Technology teachers and large number of learners from different backgrounds, incompetent teaching and poor learner results. Focusing on the necessity and importance of Technology, it was then introduced in the curriculum. On that note, teachers need support during and after the implementation of Technology so that they can overcome the impediments that they are facing. In any new curriculum that was introduced, the successful implementation of it depends on the competency of teachers who are practicing Technology in the classroom.

Technology was introduced in South Africa for the first time in 1998 as a subject through C2005 which was revised in 2002 and there were no trained Technology teachers (Mapotse & Gumbo 2013 in Gumbo 2018:135). The Department of Basic Education (2002:14) states that Technology contributed to learners' understanding of Technology by becoming a compulsory subject in schools and it is aimed at developing learners to work on projects to solve real-life problems. The learning and teaching of Technology were reinforced through Curriculum Assessment Policy Statement (CAPS) and it is structured as Natural Science and Technology (NS & TECH) that is implemented from Intermediate Phase, i.e., Grades 4 – 6 (Department of Basic Education, 2011:9). School education in South Africa has two bands, which are General Education and Training (GET) and Further Education and Training (FET). The GET band is

sub-divided into Foundation Phase (Grades R – 3); Intermediate Phase (Grades 4 – 6) and Senior Phase (Grades 8 – 9). Technology is one of the eight subjects taken by learners at Senior Phase (Grades 8 – 9) as part of their school curriculum. It is a subject that is considered as one of the enablers for learners to compete internationally once they have finished their schooling. The development succeeded from NCS and RNCS. There is a Technology strand in every term that is developed with the intension to encourage a situation which is not difficult for the progression of content areas in Senior Phase. In each Grade at least two strands are to be developed. Technology strand starts from Grade 4 to Grade 6 and they include Structures, Processing and System and Control, which provide a good understanding of the concepts for learners not to have trouble with the strands in Intermediate Phase.

There are three main aims in NS & TECH in the intermediate phase (Grades 4 – 6) to assist in creating a concrete foundation of Technology for the Senior Phase that are enhanced by the Department of Basic Education (2011:14). The emphasis in the Intermediate Phase that leads to a solid foundation of Technology for the Senior Phase includes the following:

- Doing Science and Technology – Learners should be able to complete investigations, analyse problems, and use processes and skills in designing and evaluating solutions. This means that learners should plan and do simple investigations and solve problems that need some practical ability.
- Understanding and connecting ideas – Learners should have a grasp of scientific and technological knowledge and be able to apply them in new contexts. The main task of teaching is to build a framework of knowledge for learners and to help them with connections between the ideas and concepts in their minds – this is different from learners just knowing many facts. A question-and-answer method is not enough for assessing the learners. The previously acquired knowledge, connection, and experience made between the learners and Technology teachers must relate to the discussion.
- Technology, Science, and Society – The practical uses of Technology and Natural Science in society and the environment and have values that make them caring creative citizens must be understood. The outcomes of school-based Technology and Science should be learners who understand that school Science can be of important use to their lives outside the school. Though, Science and Technology learners can have many

opportunities that could lead them to have bright futures and work opportunities.

Department of Basic Education (2011:10) states that in Technology Education, the main content areas in processing and design skills that are emphasised in Intermediate Phase (Grades 4 – 6), amongst others, are:

- Designing/Constructing: building or assembling an object using appropriate watering materials and tools and using skills such as measuring, cutting, folding, rolling, gluing,
- Evaluating and improving products: using the criteria to assess an object and then state or carry out ways to refine that object, and
- Communicating: using written, oral, visual, graphic and other forms of communication to make information available to other people.

Technology is a subject that provides learners with an opportunity to learn the skills and knowledge while creating positive attitudes, perceptions and aspirations towards technology-based careers (Department of Basic Education, 2011:9). In the RNCS, the purpose of Technology is stated as: "Learner develop skills, knowledge, competencies and confidence", that equip them to explore subject specific knowledge and the development of vocational skills, as well as several twenty-first-century skills which will enable them to contribute to South Africa's social and economic development, the Department of Education (DoE) (2002:5). RNCS was replaced by CAPS which is more focused on listing the teaching content rather than on the needs of the country (Umalusi, 2018) to develop employment opportunities. As part of the purpose of Technology, Department of basic education states, that "the subject stimulates learners to be innovative and develops their creative and critical thinking skills". It teaches them to manage time, material and resources effectively, provides opportunities for collaborative learning and nurtures teamwork (DoE, 2011:8).

Technology is mostly prioritised for the developmental success of all the nations. Technology is intended to develop learners' technological related skills such as management, e.g., time and resources, entrepreneurship and communication (Reddy, Ankiewicz, De Swardt & Gross, 2005 in Du Toit & Gaotlhobogwe, 2018:3). Nokwali *et al.*, (2014:465) attest those efforts to establish Technology Education as a subject, specifically for a growing and successful country like South Africa, could not have been emphasised. Technology has been considered in developing

countries like Nigeria and Philippines (Nokwali *et al.,* 2014:465). Since its inception in 1998, there were no qualified teachers to teach it. Ultimately, teachers with qualifications in other traditional subjects were requested to teach Technology Education (Gumbo, 2018:135). Gumbo (2016:3) attests that the teachers who specialised in subjects such as Science Education and Consumer Studies were requested to teach Technology and were only trained later through workshops as Technology teachers. Teachers only taught the areas they felt confident in, hence, they were not sure of what to teach (Sedio, 2013:4). From the researchers' point of view, they taught Technology according to their speciality in other subjects, which is one of the experienced impediments that hindered the effective implementation of the subject. Farman, Gumaelius and Norstrom (2015:26) argue that at that time it was not clearly defined in what ways Technology differed from established science subjects, and in many schools, it was lost among other subjects. Many learners were not even aware of having studied Technology.

According to Nokwali *et al.,* (2014:465), the aim of Technology as a subject is to enhance the development of content areas in Technology Education such as design, make and evaluate. Implementing Technology Education is sometimes a challenge. It has an unfortunate history of being under-funded and under-resourced. Schools are faced with challenges of lack of resources as well as unqualified teachers as stated above. This challenge is further attested to by Steven (2006) and William (2009) (in Nokwali *et al.,* 2014:465), who claim that Technology Education suffers lack of resources, and that Technology teachers experience challenges with regard to its implementation.

The different impediments in Technology will best be understood by teachers with pedagogical content knowledge (PCK) of the subject matter. It was also anticipated that being aware of these impediments would help to bring change in the way teachers would teach, as well as in the way learners would learn. For the effective implementation of Technology in schools, teachers have to be well acquainted with PCK of the subject matter. In many schools, Technology was assigned to teachers with training either in Physics, Biology and Chemistry (Fahrman *et al.,* 2015:26). On that note, teachers who are not qualified to teach Technology are faced with many challenges in implementing the subject effectively at school level (Chigona, Chigona, Kayongo & Kausa, 2010:21).

Due to the limited time frame for the implementation of the subject when it was first introduced there was little time to train teachers to teach Technology and furthermore came with

challenges (Makgato, 2014:3689). Many teachers seem to sit with the problem still. Effective learning is ultimately and primarily cantered on effective teaching. A teacher is effective if the learners can master and learn the intended outcomes. Teachers should then be experts of their subject (Shulman, 1987). They should focus on learning and learning outcomes by having a strong understanding of PCK (Shulman, 1987; Ablesser, 2012:68). The impediments that Technology teachers face, however, render them not as experts yet. According to Engelbrecht *et al.*, (2007:587) Technology is a whole new learning area with a unique content which is unfamiliar to most of the teachers. Engelbrecht *et al*., (2007:587) attest that many teachers lack experience in the respective themes of Technology. Essentially, these teachers lack the necessary competencies to facilitate Technology properly. For good and performance of learners in the subject, depends on the ability of teachers. One of the impediments is that the ineffective teaching and learning of Technology does not completely depend on unavailability of resources, but also the inappropriate knowledge, skills and the negative attitude of teachers towards the subject. This is in concurrence of the study conducted by Makgato (2014:3691), which found that the Department of Basic Education should intensify the practical skills of using materials and resources to produce creative and critical thinking of teachers, as well as to ensure effective teaching and learning in the Technology classroom.

Jones and Moreland, (2004:122) concur that through the well-developed curricula, Technology Education programmes are able to enhance an academic content and a higher order of thinking skills. Teachers across all grades went through workshops to expose them to the new curriculum (Aldridge *et al.,* 2009:147). However, teachers still encounter some challenges across all grades. Some of the challenges faced by teachers come from lack of clarity and confidence in terms of assessment policies, thus affecting the integration of teaching, learning and assessment, and inadequate teacher development. The researcher argues that PCK is the hallmark of any teacher's expert knowledge in the subject. The concept of PCK was first introduced by Shulman (1986:8), which refers to teachers' interpretations and transformations of subject matter knowledge in the context of facilitating learners' learning. Driel, Verloop and De Vos (1998:673) attest that PCK forms an understanding of ordinary learning problems experienced by learners and this is regarded as a form of practical knowledge utilised by teachers for guiding actions in a highly contextualised classroom environment. According to the researchers' knowledge, PCK might be regarded as the teachers' deep understanding of the subject matter to develop the learners' technological literacy. In the context of PCK, Technology teachers should possess a thorough knowledge of content and a deep

understanding of the subject matter in order to be effective in their teaching (Gumbo, 2014:481). Lack of knowledge, skills and understanding of the subject matter creates an ineffective Technology teaching, which is an impediment to the development of PCK. Gumbo, Makgato and Muller (2012:24) concur that most Technology teachers started teaching the subject with less PCK.

Since the implementation of Technology as a subject in schools, teachers were overwhelmed by many impediments emanating from curriculum reviews. These curriculum reviews have implications for the PCK of Technology teachers and their conceptualisation of what being a successful Technology teacher means (Nicholas & Lockley 2010 in Gumbo, 2014:480-481). In addition, many attempts that took place in curriculum reviews between 2000 and 2009 to get rid of Technology Education have not only added to the confusion but dampened Technology Education teachers and other stakeholders' eagerness to know more about the subject (Gumbo, 2018:135). Technology Education requires a teacher with a deep understanding of the content. In terms of technological knowledge, Technology Education requires a teacher to have a clear understanding of conceptual and procedural knowledge of the different technological areas (Gumbo, 2014:481). Procedural knowledge encompasses the activities and conceptual knowledge which relate to the body of content (William, 2002:48). Williams (2012:35) agrees that Technology Education also indicates that many of these student teachers actually lack a deep conceptual understanding of the subject matter. Because Technology Education teachers lack a deep understanding of the content, they experience many impediments in relation to the subject in context. The majority of teachers still lack Technology Pedagogical Content Knowledge (TPCK) to teach the subject with confidence and in every chance of success.

It has been twenty years since the implementation of the C2005 in Grades 8 - 9 classes and still, teachers in these grades seem to be struggling with a common understanding and practice of Technology Education. Support from the Education Management and Development Centres has been quick enough, especially because of the lack of sufficient funding, inadequate training of subject specialists as well as the large number of rural area schools in the Nkangala Sub-District that need teacher training in terms of the curriculum. The Grades 8 – 9 teachers in these schools are presently experiencing huge problems in relation to understanding the curriculum and how it should be practiced in their respective classes. Most Technology teachers' real challenge is not only how to make teaching better but preferably how these teachers'

improvements are supported (Dichaba & Mokhele, 2012:249). Technology teachers should also be helped to learn the new ways in which they can teach the subject with confidence.

1.3 STATAMENT OF THE RESEARCH PROBLEM

Although many Technology teachers are trained to teach Technology, teachers at Nkangala Sub-District are still overwhelmed by the confusion surrounding the understanding and teaching of the subject (Mupa & Chinooneka, 2015:125). The whole curriculum process has to endure many impediments from teachers serving at Nkangala Sub-District schools in relation to its implementation. According to Chigona *et al.,* (2010:21), curriculum changes are a challenge for most teachers, regarding Technology Education, especially those who are not qualified in the subject yet. Although various interventions have been made since the implementation of Technology as a subject, there seems to be a lack of appropriate teaching practices and that could lead to one of the impediments to teaching Technology. These impediments relate to the understanding and the practice of Technology itself. All these are the effects of the ineffective implementation of Technology Education that give the impression that it was not carefully thought through, piloted, or resourced, and thus left enormous stresses and strains in the widely divergent educational context (C2005 Review Report, 2000:3).

Most of the time teachers teach for a long time without being visited by subject specialists for possible development (Makgato, 2014:3689). This might explain why teachers experience impediments in the Technology classroom. Wicklein (2004:6) attests that in these critical times it is imperative that we utilise every available resource to build and establish our field of study and to address and solve the issues and impediments that Technology teachers now face. The impediments created by lack of understanding, resources, and practices in the teaching of Technology have affected teachers' practices and performance in Nkangala Sub-District schools. This implies that the professional development of teachers in these areas should go hand-in-hand with curriculum implementation. Stoilescu (2014:64) emphasises that in order to be able to teach Technology Education concepts, teachers must use them efficiently in class. Teachers need to be helped to develop planning, collaboration, and determination in teaching the subject. They should be able to reflect on strategies, representations, and visions that make purposeful use of a specific Technology for their learners. All this seems not to be in place with Technology teachers at Nkangala Sub-District schools, thus creating a need for research to understand the impediments that they face in the field. From the implementation process, many

of the impediments encountered were created by factors such as lack of funds in the rural area schools and inadequate training of Technology Education teachers (Zwane & Malale, 2018:2). The researcher thus came to understand that one should not only be blinded by the impediments to the implementation process, which led to a poor understanding and practice of Technology Education, but also the context in which the curriculum was developed and implemented.

Presently, there is still a lot of confusion surrounding the conceptualisation and practices of Technology Education (Mandukwini, 2016:3). Most teachers quit the teaching profession in search of jobs that are more profitable and less pressurised. It has been twenty years since Technology Education was implemented in the Grades 8 – 9 classes and yet there still remain different interpretations amongst them as to what Technology Education is really all about. Although a need to revise curriculum changes has been realised, teachers are still plagued by confusion surrounding the understanding and practices of Technology Education as a subject. Mapotse (2012:2-3) concurs that in terms of terminology and content in the curriculum, Technology teachers found it to be very much complicated, demoralising, and confusing to implement the subject, e.g., the term 'learning area' in the NCS will now be 'subject' in CAPS, 'learning outcomes' and 'assessment standards' will now be 'topics' and 'core content areas' in CAPS, respectively.

1.4 RESEARCH QUESTIONS

1.4.1 The main research question

The main research question which emerges from the above problem is thus stated as follows: *What is the nature of impediments that Grades 8 – 9 teachers of Technology face in the Nkangala Sub-District of Mpumalanga?*

1.4.2 The research sub-questions

This research question leads to the following sub-questions:

- What impediments do Grades 8 – 9 teachers of Technology identify in their practice in Nkangala Sub-District?
- How do these impediments affect Technology teachers' practice?
- What are strategies through which these impediments can be overcome?

1.5 AIMS AND OBJECTIVES OF STUDY

The primary aim of the study is to understand the nature of impediments that Grades 8 – 9 teachers of Technology face in the Nkangala Sub-District of Mpumalanga. This aim was achieved through the following objectives:

- To explore the impediments faced by Grades 8 – 9 Technology teachers in Nkangala Sub-District.
- To determine how these impediments affect Technology teachers' practice.
- To propose the strategies through which these impediments can be overcome.

1.6 SIGNIFICANCE OF THE STUDY

The aim of the study is to understand the nature of impediments that Grades 8 – 9 teachers of Technology face in the Nkangala Sub-District of Mpumalanga. This study creates an understanding of the nature of impediments that Grades 8 – 9 Technology teachers face in their practice, and how they actually affect the practice. The study also responds to the question stated in 1.4 proposing the strategies as to how to overcome these impediments. Understanding the impediments that Technology teachers face in the identified context, will help bring improvements that could boost the morale of Technology teachers in the subject. It could also help direct the improvements that might be necessary for the current professional development training for Technology teachers. This study thus contributes new insights towards practice and knowledge concerning the teaching of Technology, especially in Nkangala Sub-District.

1.7 AN OVERVIEW OF RESEARCH METHODOLOGY

In this section, the research design, approach, methods and data collection procedure are discussed in order to source the required empirical information from the participants as they narrate their experiences about the impediments that they face in their practice.

1.7.1 RESEARCH APPROACH

The study followed a qualitative research approach to uncover the experiences of teachers regarding the impediments they encounter in Technology (Creswell. 2009:156). In order to gain an in-depth understanding of the teachers' experiences, inductive approaches were applied, which are characteristics of qualitative research. A qualitative approach is therefore used to gain an understanding of the real situation faced by teachers in Nkangala Sub-District

schools. In addition, qualitative researchers collect data at the site where the participants experience the issue or problem under study (Creswell, 2007:37)

1.7.2 RESEARCH DESIGN

Research design is a plan of how the researcher will systematically follow a particular approach to collect data and analyse the data required to answer the research questions (Bertram & Christiansen, 2014:40; Terre Blanche, Durrheim & Painter, 2006:563). In this study, a case study design was adopted to answer "what", "why" and "how" questions related to the study (Saunders, Lewis & Thornhill, 2012:179). Rule and John (2011:4) define a case study as a systematic and in-depth study of one particular case in its context. This type of design is aimed at capturing the reality of the participants' experiences and thoughts on a particular situation, (Creswell, 2012:465), for example, the issues that are associated with the subject of Technology in this study. This type of design was chosen because it allows the researcher to examine a particular case in a great deal of depth instead of paying attention to multiple instances superficially (Rule & John, 2011:7; Yin, 2003:313). According to Welman, Kruger and Mitchell (2005:193), the term case study pertains to the fact that a limited number of analyses are studied intensively. In this study, case studies are more exploratory, focusing rather on the generation of theory than on testing (Yin, 2003:13). A multiple case study was chosen for the study as it provided an opportunity to observe and analyse a phenomenon few have considered before (Saunders, *et al*., 2012:179). The researcher involved twelve Technology teachers from different schools in this current study.

1.7.3 POPULATION AND SAMPLING

Population refers to a group of people that is of interest to the researcher (Fraenkel & Wallen, 2007:93). The population of the study consisted of teachers who are teaching Technology from different schools in Grades 8 – 9 classes in Nkangala Sub-District. In Nkangala Sub-District, there were 78 Technology teachers from 26 schools in four circuits at the time of the investigation. A sample of Grades 8 – 9 Technology teachers was done from this number of teachers.

According to Polit and Beck (2008:339), the term sampling is regarded as the process of making a choice from a portion of the population so that inferences about the population can be made. The researcher selected participants using purposive sampling to take part in the study. Purposive sampling refers to a technique where the researcher selects participants who

are knowledgeable about the phenomenon under investigation (Struwig & Stead, 2013:130; Collis & Hussey, 2014:132). De Vos, Strydom, Fouche and Delport (2011:232) attest that this sampling technique is based entirely on the judgment of the researcher in the sense that a sample is composed of the population that serves the purpose of the study. Fifteen Grades 8 – 9 Technology teachers were selected from four rural schools at Mmametlhake, Nokaneng, Marapyane and Libangeni circuits and only twelve participated in the interviews (one teacher per grade per school per circuit).

1.7.4 RESEARCH METHODS AND DATA COLLECTION PROCEDURE

The researcher used one on one semi-structured interviews between the researcher and the participants as a data collection method (De Poy & Gilson, 2008:149). Welman *et al*., (2005:166) indicate that this type of method enables the researcher to have a list of themes and questions to cover during the interview. This method is appropriate for the study because it afforded the researcher the opportunity to explore the subject under investigation to get in-depth data from the participants. The participants were also at liberty to share more experiences during interviews, as they were not held tied to questions such as in a structured interview, except that a few key questions are used as guiding document questions in the semi-structured interview.

The second data collection method to be used is observation (Stoilescue, 2014:60). It enabled the researcher to observe any impediment that the teachers faced especially during teaching. The researcher negotiated to observe individual teachers from two schools' Grade 8 – 9 classes. Accordingly, observation enables the researcher to observe things that cannot be obtained through interviews. The researcher observed the following impediments as identified by Bertram and Christiansen (2014:85) with regard to (i) teachers' classroom practices, (ii) the interactions between teacher and learners, (iii) the challenges that are experienced during teaching, and (iv) the educational environment.

1.7.5 DATA ANALYSIS

Data analysis is regarded as a process whereby the researcher brings order, structure, and meaning to the mass of collected data (De Vos *et al*., 2011:397). For the purpose of the study, data were analysed using Tesch data reduction of open coding. This process was guided by Creswell's (2009:185) six-step approach to data analysis that consists of (i) transcribing interviews, (ii) reading through all the data, (iii) coding data, (iv) generating themes, (v)

advancing how themes are represented in the qualitative narratives and (vi) interpreting the meaning of the data. With regard to observation, the researcher used the sticky notes created during the observation. In analysing the observation, the researcher grouped the sticky notes that were related to the same category, following the sequential steps as reflected in Chapter 3.

1.7.6 MEASURES TO ENSURE TRUSTWORTHINESS

The concept of trustworthiness consists of four elements. In this study, trustworthiness was addressed through a variety of elements identified by Lincoln and Guba (1985:301) thus:

- Credibility – this refers to the confidence that the researcher has in the truth of the research findings and essentiality means the believability of the findings (Polit & Beck, 2008:539). In ensuring credibility, the researcher triangulated the findings across the same grades by the methods used. Furthermore, the researcher embarked on a prolonged engagement, which is, investing sufficient time to achieve the purpose of data collection and build trust among participants (Lincoln & Guba, 1985:301).
- Transferability – this relates to the applicability of the research findings in other contexts or situations or even populations. While observing the fact that qualitative research is context-bound, the researcher used the descriptions in data analysis (Lincoln & Guba, 1985:316) to provide adequate descriptions to enable other researchers to evaluate the applicability of the findings in other contexts (Polit & Beck, 2008:539).
- Dependability – this relates to the extent to which the study can be repeated by other researchers and yield the same findings. Accordingly, the researcher used a co-coder to ensure that the themes that are experienced do not come out of the biases of the researcher. An audit trail was performed to consolidate dependability.
- Confirmability – is associated with the impartiality of the findings of the study that are based on the participants' responses and not influenced by the researcher's personal interest or biasness. Lincoln and Guba (1985:316) believe that audit and trail can be of assistance in this regard.

1.8 ETHICAL CONSIDERATIONS

The study was conducted within the rules set out by UNISA's ethics code enshrined in the policies. The researcher also requested permission from the Kwa-Mhlanga region to conduct the study. As soon as the approval was granted, the circuit managers and the principals were

contacted about the intention to conduct the study. The researcher asked the participants to consent to participate in the study using the designed consent form. The form had information about the participants' rights, for instance, to withdraw from the study at any given time without any prejudice, voluntary participation, and anonymity.

1.8.1 Permission to conduct the study

Prior to data collection, the researcher requested permission from the Nkangala district to conduct the study in selected circuits. The Nkangala district granted the research approval letter. The circuit manager was informed about the study and the letter was sent to the principals of schools to arrange for an appointment.

1.8.2 Informed consent

Participants were invited to take part in the research study that explores the impediments faced by Grade 8 – 9 Technology teachers in Nkangala Sub-District. They were informed that the information in the consent form would assist them to decide if they would like to participate in the study. Before they agree to participate, they should understand what the study would entail. Therefore, the participants would be informed about the goal, the requirements for participation, the risk (if any) the time frames, the duration, recording of information, facts pertaining to their withdrawal from participating in the study, their rights, the potential benefits of the study to them, confidentiality and anonymity. The participants were requested to sign the consent letter indicating their voluntary participation and rights. The informed consent letter is attached as Appendix E.

1.8.3 Voluntary Participation

Participation in the study would be absolutely voluntary, which means that if they are willing to participate in the study, they are free to withdraw if they felt uncomfortable. They would be allowed to withdraw at any given time without providing a reason for their decision.

1.8.4 Anonymity and Confidentiality

Anonymity and confidentiality are guaranteed in this research study. Neither the researchers nor the readers of the findings can identify a given response with a given respondent; the researcher can identify a given person's responses but promises not to do so publicly (Babbie, 2008:428). All the information gathered during the course of this study is strictly confidential. The study data would be coded so that they would not be linked to the participants' names. No

personal identifiers would be revealed while the study is being conducted. The information obtained would only be used for research purposes. The respondents' information and recordings would therefore be kept anonymous.

1.8.5 Respect for participants' dignity

A consent letter would be given to the participants to read; if they are content with the study, they give permission to proceed with the interview. The methodology aspects of the study would be coded so that they would not be linked to the participants' names. The researcher determines not to use the participants' real names and those of the target schools.

1.8.6 Respect for privacy

All the data provided during the study would be handled confidentially. This means that access to a participant's data, such as in the form of types, interview transcripts, and observation field notes, is limited strictly to the researcher, the supervisor of the study, and the designated examiners. The participants' answers would be anonymous, and their identities would not be revealed under any circumstances. Nobody outside the study panel would be able to connect any answer to the participants in any recognisable way.

1.8.7 Covid-19 regulations

Covid-19 regulations would be adhered to. Participants are at liberty to withdraw their participation if they felt uncomfortable due to the state of Covid-19. They are also free to request online interviews.

1.9 DEFINITION OF TERMS

Impediments: an impediment means a new or difficult challenge that makes you try hard. In the context of this study, an impediment is regarded as the challenge experienced by Technology teachers during their teaching practices in Technology classrooms, such as understanding of the subject and shortage of resources. In this case, the definition as such emphasises that impediments in Technology Education are difficult to understand and are changed by different factors. This includes among others how ready the teachers are in changing their own ideas of Technology and Technology Education, the type of experience, the level of encouragement as well as different actions provided to teachers at all times (Jones, Bunting & De Vries 2011 in Mapotse & Gumbo, 2013:553).

Implementation: means doing or starting using something that you have already planned. Implementation refers to enacting (by teachers) Technology Education in schools as one of the subjects in the curriculum (Department of Education Policy Act no 27 of 1996).

Technology: broadly speaking technology can be defined as how people change the natural world to suit their own purposes. Technology is derived from the Greek word "techno" which means art and craft but more specifically, it refers to a lot of different things such as processes and knowledge that people use to extend human abilities and satisfy human needs and want, International Technology Education Association (ITEA, 2001:1). In CAPS, technology means "the use of knowledge, skills, values, and resources to meet people's needs and wants by producing ways of solving problems of doing things, taking into cognisance the factor of being with other people and the environment" (Department of Basic Education, 2011:8). "Technology is the use of knowledge, skills and resources to meet human needs and wants and recognise and solve problems by investigating, designing, developing and evaluating products, processes and systems'' (National Education Policy Act no 27 of 1996 in Heymanns, 2007:39).

Technology Education: is the study of the facilitation of learning Technology to make it meaningful to learners with the aim of improving their performances by creating, using, and managing appropriate technological processes and resources (Gumbo, 2016:9). Technology Education is a school subject intended to promote technological literacy in learners and to qualify them as engineers, artisans, technicians, etc. (Gumbo 2018:137). Technology Education can consequently be defined as concerning technological knowledge and skills, technological processes, understanding of the impact of Technology on both individuals and society, designed to promote the capability of the learner to perform effectively in the technological environment he/she lives in, and stimulate him/her to contribute towards its improvement (HEDCOM, 1996:12) in (Heymanns, 2007:39).

Pedagogical content knowledge: PCK means a deep understanding of the subject content. In other words, it means that the teacher possesses knowledge and skills that distinguish him from novices or less experienced people, undergird superior reproducible performances of representative tasks, single him out as an authoritative source of knowledge, techniques, and skills, and expresses intense experience through practice and education in a particular field (Ericsson *et al*., 2006; Pisova & Janik 2011 in Gumbo & Williams, 2014:479).

Effective teaching: is a skilled and purposeful activity involving complex processes of pedagogical reasoning and actions (Shulman, 1987 in Williams, 2012:34).

1.10 ORGANISATION OF THE STUDY

CHAPTER ONE: INTRODUCTORY CHAPTER

The chapter provides the background and statement of the problem, research questions, aims and objectives, and the significance of the study. Furthermore, it deals with the research methodology employed in the study. It also gives an account of the research design, research approach, the sample used, the ethical considerations, data-gathering methods, analysis of the study, and literature consulted in conducting this research.

CHAPTER TWO: THEORETICAL FRAMEWORK

Chapter Two discusses various theories related to Technology Education. The theory underpinning the study is described, motivated, and an account of its applicability in the study is given.

CHAPTER THREE: LITERATURE REVIEW

The researcher reviewed the relevant literature to determine the impediments faced by the Technology teachers of Grades 8 – 9 in Nkangala Sub-District schools of the Mpumalanga Province. The researcher then reviewed the legislature, regulatory, and policy mandates that are employed to fast-track teacher training for the transformation of the education system. Special attention is directed to the introduction of Technology as a subject.

CHAPTER FOUR: RESEARCH METHODOLOGY

This chapter discusses the research methodology and deals with the research design, population, and sampling, the research approach and methods, data collection procedures, data analysis, significance of the study, measures to ensure trustworthiness, and ethical considerations of the study.

CHAPTER FIVE: PRESENTATION OF RESULTS AND INTERPRETATION

This chapter essentially presents and discusses the findings of the study, which respond to the impediments faced by Grades 8 – 9 Technology teachers in Nkangala Sub-District schools of the Mpumalanga Province.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

This last chapter presents conclusions and provides recommendations emerging from the research.

CHAPTER 2

THEORETICAL FRAMEWORK

2.1 INTRODUCTION

This chapter discusses PCK theories that frame this study. PCK is a teacher's knowledge of content merged with the knowledge of how to teach that content (Shulman, 1986). This theoretical framework played a crucial role in answering the research questions of the study on the teaching experiences of Grades 8 – 9 Technology teachers. This theory was considered appropriate for the study because of its potential to facilitate an understanding of the impediments encountered by Technology teachers. The chapter further examines, among others, the evolvement of PCK, its main elements, and how it can be related to teacher knowledge. A teacher should exhibit competence in his/her PCK. Gumbo and Williams (2014:479) assert that the teachers' PCK is the area that is under-researched in Technology Education. Maluleka, Wilkinson and Gumbo (2006:507) concur that researching this phenomenon is most crucial for Technology teachers considering the relative newness of the subject compared to other traditional subjects in the curriculum. Science, Mathematics, Housecraft, Arts and Culture, etc., form part and parcel of indigenous knowledge whereby teachers should have a thorough understanding of the traditional subjects, to disseminate it to the learners to be consistent with their cultural background. Their acquisition of PCK can tell how they respond to the impediments that they might be facing. It was for these reasons that the researchers deemed it necessary to explore the PCK of teachers faced with impediments in the teaching of Technology in order to determine their levels of expertise.

2.2 UNPACKING THE NOTION OF IMPEDIMENTS IN TECHNOLOGY TEACHING

This study explores the impediments faced by Grades 8 – 9 Technology teachers with regard to their PCK in the Nkangala Sub-District of the Mpumalanga Province of South Africa. The aim of this chapter is to explain the relevance of PCK to the study. Shulman (1986) introduced the notion of PCK that contributes to effective teaching and learner learning. However, according to Hill (2008:372), effective teaching requires Technology teachers to have unique knowledge of learners' technological ideas and thinking that are an important component of

teacher's knowledge. In the researcher's point of view, Technology teachers who possess this knowledge experience fewer impediments in their teaching. Shulman and Shulman (2004:1) created a new frame for conceptualising teacher learning. In addition, they concurred with the fact that the conception of PCK allowed them to understand the different ways of preparing teachers to create, sustain and educate in a community of learners. The utilisation of PCK has been heavily placed on teacher quality in teaching Technology by improving teachers' knowledge of subject matter knowledge and teaching (Lee, 2010:28).

In educational practice there are many models and research theories that can be considered for different reasons and contexts. This implies that teachers possess different practices based on theories of teaching and learning that are attained from their training. This does not necessarily mean that every teacher can apply these theories exactly the way they were taught in college or university. The impediments in the context of this study are considered what teachers experience when confronted with the task of facilitating learning of a specific cohort of learners in a particular situation. The impediments can be experienced differently by teachers and from situation to situation. In other words, the impediments are the products of teaching practice where teachers experience difficulties to progress in their teaching. Furthermore, impediments are revealed by teacher actions in situations in the classroom. Situational action considers the individual teacher's level of professional competence. Therefore, in order to understand the impediments faced by Technology teachers, it was imperative for the researcher to understand the theory used in the study. For effective teaching to occur, it is imperative for Technology teachers to have the PCK of the subject matter that will determine their professional competency (Jones & Moreland, 2007:193).

The study is not only about the teachers' application of the theories they learned during their training. This cannot be the only case as it was indicated in the background of the study that some of the teachers were not trained in some areas of Technology Education. The emphasis of the study is also to look at every possible action to identify the impediments, and justification thereof by teachers in their teaching of Technology. According to Jones and Morelands (2007:193), good Technology teaching is about the teachers' deep understanding of the subject matter that focuses on encouraging and supporting learners to move forward in the learning of Technology. Gumbo and Williams (2014:481) attest that the teaching of Technology happens through identifying and solving the technological problems through the technological process

that plays a key role in directing problem-solving activities. In other words, the teaching of Technology referred to includes all the actions that teachers engage themselves in to enhance learning in different situations of their practice. In addition, effective teaching occurs when the teacher explains the subject matter with the aim of finding various ways to make it clear and accessible to learners. These actions may not necessarily be effective, but compromises that they are considered helpful in identifying impediments at that time. Understanding these actions would thus require multiple theoretical lenses, not PCK only. As teachers know, teaching is a complicated practice that requires the interaction of many kinds of specialised knowledge.

2.3 PEDAGOGICAL CONTENT KNOWLEDGE

In the context of a theoretical perspective, teaching practices can mean many things in this case, in the conceptual and procedural knowledge. It is imperative for the purpose of this study, to consider PCK to guide the study specifically, and in the light of the different types of knowledge, the teacher brings into the learning situation. Pedagogical Content Knowledge involves all actions performed by Technology teachers about what, how and to what extent should content be transferred to their learners (Romylos, 2018:66). According to Rice and Kitchel (2017:50), PCK is the most important knowledge base that Technology teachers can possess. The study is based on a modified model of PCK.

Shulman (1986:8) is regarded as the father of PCK. Shulman first introduced the concept of PCK and refers to it as the teachers' interpretations and transformations of subject matter knowledge into context. Asunda and Mativo (2016:9) add that PCK refers to the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction. Shulman first introduced the PCK concept into the educational realm after he had noticed that policies in the 1980s that dealt with teacher competency ignored content and focussed largely on basic pedagogy (Koehler & Mishrah, 2009:62). Hill, Ball and Chilling (2008:372) attest that most scholars and policymakers have assumed that the notion of PCK also contributes to the effective teaching of Technology and learner learning. Shulman 1986:9) also realised that there was a gap in research regarding subject matter content, and that research literature on subject matter content teaching was lacking. This absence of content in research translated into policymakers also ignoring it when setting standards for teacher

competency evaluations. “No one asked how subject matter was transformed from the knowledge of the teacher into the content of instruction” (Shulman, 1986:6). The PCK is described as a “particular form of CK that embodies aspects of content most relevant to the teaching ability” Shulman (1986:9). According to Ball, Thames and Phelps (2008:389) PCK also includes an understanding of what makes the learning of specific topics understandable or difficult.

The study is based on a modified model based on the ideas of Shulman (1986; 1987) regarding PCK. According to Rise and Kitchel (2017:51), PCK is not just an important aspect of teaching, it is arguably the most important knowledge base a teacher can possess and is considered critical for effective teaching in Technology Education. Pedagogical Content Knowledge is an academic construct that represents an intriguing idea rooted in the belief that teaching requires considerably more than delivering subject CK to learners, and learners considerably absorb information for later accurate regurgitation (Loughran, Berry & Mulhall, 2012:7). As a researcher, PCK can be defined as the deep understanding of the teachers’ experience in determining the impediments that they come across in their teaching practices.

After the introduction of PCK in 1986, practitioners regarded the idea as being useful and an interesting research topic (Maniraho, 2017:20). Shulman (1986) argues that PCK should include the knowledge in practice that helps teachers to direct what is done in classrooms related to the organisation of the content for pedagogical purposes (Maniraho, 2017:20). The teacher is supposed to know *how* (pedagogy) and *what* (content) to teach, as emphasised by Shulman, (1987:13). The researcher is of the opinion that PCK is a teacher’s understanding of how to help learners understand the specific subject matter.

In the context of the above, Williams (2012:35) and Driel and Berry (2010:658) concur on the same factors that contribute to the development of a sound PCK as a necessary process revolving in the context of subject matter knowledge by teachers, demonstrated through the following assertions:

- Good subject matter: This refers to the Technology teachers’ CK in a subject matter which can make them impart it effectively to the learners. A teacher’s limited PCK may lead to the lack of his/her confidence in teaching the subject, thus hindering his/her

practice. It is therefore important for Technology teachers to have a sound knowledge of their subject matter in order to disseminate that successfully to the learners. According to the researcher, Technology teachers who possess good subject matter knowledge can utilise a variety of methods and strategies to achieve the learning outcomes successfully. Such teachers are able to introduce the lesson by connecting learners' prior knowledge with the new knowledge, involving them in problem-solving skills, and assessing them before, during and after the lesson (Brown, Ernst & Clark, 2017:30).

- Classroom and teaching experience: The use of both terms have been bundled together in Technology Education. Technology teachers with good teaching experience play an important role in the process of teaching. In Technology Education, a teacher with relevant classroom experience can deal with classroom management effectively. At the beginning of the school year, learners should be introduced to the rules and procedures of the classroom. A Technology Education classroom with different equipment can be simply managed by a teacher who has his/her plans for the lesson well prepared, which takes an experienced teacher to do. Lack of experience suggests that teachers have little or no PCK and therefore, they may lack confidence in facilitating their lessons. The lack of confidence in teaching the content is an impediment to most Technology teachers that could derail imparting subject matter content in the classroom.
- Possession of emotional attributes such as self-confidence: Technology teachers who offer the subject with self-confidence have the great possibility to disseminate the subject matter effectively and successfully. It is imperative for a Technology teacher with self-confidence to understand the different ways in which learners learn when preparing his/her teaching strategies. According to the researcher, a self-confident teacher is able to adapt the curriculum in different ways to ensure the learners' success and to meet their learning needs. For example, he/she can modify the content, the process of teaching, and the required outcomes. Therefore, learners will be able to utilise their strengths, learning styles, and prior knowledge. Furthermore, a self-confident teacher can engage learners in critical thinking and problem-solving experience.

Teaching strategies represent the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to the diverse

interests and abilities of learners, and presented for teaching (Shulman, 1987:8). The impact that teachers' PCK has on the classroom and the teaching of Technology is the development of teachers' understandings of the subject ideas and how these might be translated to best fit their learners (Jones & Moreland, 2007:193). It includes an understanding of what makes the learning of specific topics easy or difficult. It also represents the conceptions and preconceptions that learners of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons (Shulman 1986: 9). Gumbo (2014:386) asserts that indigenous technology is less taught in the South African classrooms when it comes to the teaching and learning of Technology. The researcher takes into consideration the fact that Technology teachers should possess indigenous PCK for their expert teaching. The lack of indigenous knowledge in the teaching of Technology is an impediment to most of the teachers. Maluleka, Wilkinson and Gumbo (2006:507) concur that through the knowledge of indigenous technology, new methods and other technologies can be developed. From the Stone Age, man used various methods to shape stones, wood, bone, skin, and iron to make tools for survival. Furthermore, stones, for example, were used for hunting and other forms of food manufacturing in agriculture. Stones are still mined currently – a teacher can show the connections between indigenous technology and conventional technology. According to the researcher, it is imperative for indigenous technology to be regarded as being pertinent as the curriculum purports since it can enrich the teachers' PCK and make them respect the indigenous contexts that they teach.

In the context of the above, PCK includes knowledge of how particular subject matter topics and problems can be organised and adapted to the diverse interests and abilities of learners. Teacher knowledge starts with the PK and the CK. Pedagogical Knowledge is the general knowledge about pedagogy, how learners learn teaching approaches, methods of assessment, and knowledge of different theories about learning (Jones & Moreland, 2007:193). CK is the knowledge of the subject matter without considering teaching the subject matter, e.g Mathematics, Physics, Technology, etc. (Jones & Moreland, 2007:193). Nokwali, Mammen and Maphosa (2014:466) assert that the recent curriculum includes Technology strands in the Senior Phase in Grades 7 – 9, i.e., structures, processing, and system and control that teachers should understand in order to be effective in their teaching. In addition, the major process and design skills for Technology are also emphasised, i.e., designing, making/constructing, evaluating and improving products, and communicating. Ball, Thames and Phelps (2008:391) concur that CK is concerned with the general characteristics of the knowledge that Technology

teachers should use in their teaching. According to the researcher, a Technology teacher is expected to understand why a particular topic is central to the discipline. A teacher should also make every attempt to draw indigenous perspectives into their knowledge of the subject.

In the paragraph that follows, the different theories are briefly discussed to give a clear understanding of what they are and how they would contribute to our understanding of impediments teachers engage in and their individual practices of teaching. Newsome and Lederman (1999:21) present a model that shows their interpretation of the place of PK in respect of all categories of teacher knowledge identified by Shulman (1987) as shown in figure 2.1.

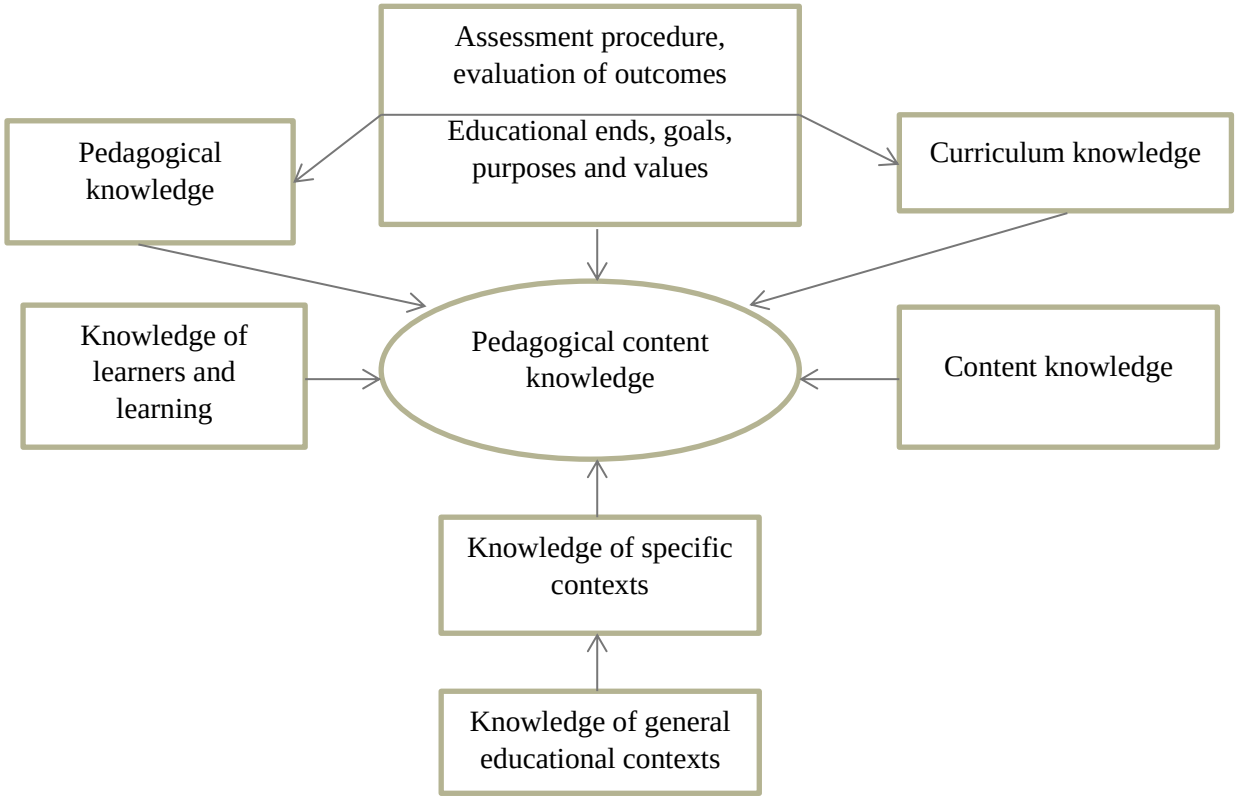


Figure 2.1: Categories contributing toward PCK (Newsome & Lederman, 1999:21).

The intersection of content and pedagogy lays the existence of PCK. In that way, it goes beyond a simple consideration of content and pedagogy being away from one another. One is the close relationship between the aims and purposes and their inseparability from knowledge about assessment processes. Another is that curriculum knowledge is powered by both the CK and

the knowledge of goals/assessment processes. And yet in the model only the category knowledge of general contexts is directed to a subcategory of knowledge of specific contexts, but each of the other categories is directly related to PCK, that means, knowledge of the specific content, knowledge of the specific curriculum and knowledge of objectives/assessment procedures of specific pedagogy and specific students.

2.4 GENERAL DIMENSIONS FOR TEACHER KNOWLEDGE

Shulman (1987) developed seven-part elements of the PCK classification on which teacher knowledge is based, namely, subject matter, pedagogical content, general pedagogy, curriculum, learners and their characteristics, educational contexts, and educational aims, and purposes and values**.** Shulman's categories were intended to highlight the important role of CK in professional knowledge of teaching. The general dimensions for teacher knowledge were considered to address the first four categories regarded as the mainstay of a teacher education programme that emphasised content knowledge. These categories are discussed subsequently.

2.4.1 Content Knowledge (CK)

According to Shulman (1986:9), CK refers to the "amount and organization of CK in the minds of teachers". Content knowledge is the first category that includes the knowledge of the subject and its organising structures (Shulman, 1989). Content knowledge is the knowledge about the subject matter that is to be taught and learned (Harris, Mishra & Koehler, 2009:397; Koehler & Mishra, 2009:63). It is imperative for teachers to understand the organising principles that will guide them on what to do in the teaching of Technology. However, lack of CK is an impediment to effective teaching for most Technology teachers hence many approaches to teachers' professional development offer a one-size-fits-all approach to Technology practices when, in fact, teachers operate in diverse contexts of teaching and learning. It is in the light of this that one of the elements of Shulman's framework cautions about the context of learners. Teaching quality is measured in terms of how much CK teachers possess (Romylos, 2018:60). It is therefore important for teachers to have the knowledge of concepts and to understand the methods and content of the subject matter they teach as lack of CK appears to be an impediment to most Technology teachers. Teachers who experience impediments in the teaching of Technology have little understanding of the content to be taught in the classroom (Koehler & Mishra, 2009:62). Therefore, lack of understanding of the content became a matter of serious concern in Technology teaching and thus motivates investigation that can bring a solution to

the problem. The researcher thinks that teachers have often been provided with inadequate training for Technology teaching from their professional development courses. For that matter, it is not surprising that Technology teachers do not consider themselves sufficiently prepared to teach the concepts in the classroom, and often do not appreciate its value or relevance to teaching and learning (Koehler & Mishra 2009:62).

Effective Technology teachers need strong CK in order to be flexible in presenting it and to cognitively challenge learners' thinking. Technology teachers' deep CK enables them to change their teaching plans based on learners' competencies so that learning activities are aligned to the learners' prior knowledge through scaffolding and designing extension work during teaching. Maniraho (2017:18) attests that it is impossible for a Technology teacher to teach without sufficient CK. Shulman (1986:10) argues that a good teacher who possesses CK must not only understand that something is like this, but also to know why and what made it to be like that. This means that teachers' knowledge should be flexible enough to be expressed in multiple representations that suit the pedagogical strategies that are possible or teachers to use in a lesson. Content knowledge is about the subject area a teacher teaches during the lesson and it answers the questions of what will be taught, thus an individual without this knowledge may have misconceptions or misleading facts regarding the area (Koehler & Mishra, 2009:64).

According to Ball, Thame and Phelps (2008:389), an understanding of the content, the organising principles, structures, and the rules for establishing what is legitimate to do and say in a field of teaching Technology, is what matters most. Shulman (1986:8) adds that teaching the subject requires teachers with a deep understanding of the subject matter. Shulman (1986) indicates that subject matter knowledge includes substantive and syntactic knowledge that goes beyond the knowledge of facts and concepts in the discipline and involves the understanding of the structure of the subject, i.e.:

- Substantive knowledge**:** It includes teachers' understanding of a variety of ways in which the basic concepts and principles can be arranged (Shulman, 1986). According to the researcher, this term refers to the use of different methods and strategies a Technology teacher introduces in the lesson to produce effective outcomes. A Technology teacher with a deep understanding of the content can utilise diversity in the classroom to cater to all learners including those with special needs.

- Syntactic knowledge: This involves the knowledge of the ways in which experts decide what constitutes "legitimate" scientific knowledge in a field being investigated (Schwab, 1978). In the context of this study, teachers should give primacy to indigenous knowledge just as the western knowledge has always been elevated above indigenous knowledge. Transformatively, therefore, they should argue for indigenous knowledge as legitimate knowledge deserving to be taught to learners. Maluleka *et al*., (2006:257) attest that through the knowledge of indigenous technology, new methods and other technologies can be developed. In addition, traditional knowledge is the root of modern knowledge. Teachers can take advantage of and build on the pronouncements of the CAPS. According to the researcher, syntactic knowledge is the ability to integrate indigenous knowledge successfully in the CAPS. Thus, the examples of legitimate technological knowledge include the following:

    - Technology teachers should understand that indigenous technology existed from the Stone Age whereby traditional people used different methods to process foods in a traditional way and that it still exists today, e.g., drying, canning, bottling, etc.
    - Stones were used for hunting, wood as a tool for plowing and its pulled by oxen, bone splinters for hunting, iron for making assegai, skin for making shields and string, wood and skin for making musical instruments.
    - African pottery is an indigenous technology that still exists today.
    - The practical clothing of different cultures is still admired today especially during cultural and heritage days.

2.4.2 Curriculum Knowledge

Curriculum knowledge refers to the "full range of programs designed for the teaching of particular subjects and topics at a given level" (Shulman, 1986:9). According to Ball et al (2008:389), in this category, curriculum knowledge is presented as a full range of programmes that are designed for the teaching of particular subjects and topics at a given level. In addition, Shulman (1986:10) indicates that there are two dimensions of curriculum knowledge that are important for teaching which are lateral curriculum knowledge and vertical curriculum knowledge. Lateral knowledge relates to the knowledge of the curriculum being taught to the curriculum that learners learn in other classes and in other subject areas.

Vertical knowledge includes “familiarity with the topics and issues that had been and will be taught in the same subject area during the preceding and later years in school and the materials that embody them”. According to Shulman (1986:10), the remaining three categories define content-specific dimensions and are referred to as the missing paradigm in teaching and research.

2.4.3 The knowledge of learners and their characteristics

To employ PCK effectively, teachers should have knowledge of learners’ conceptions of particular topics and their learning difficulties (Park & Oliver, 2008:266). Teaching them effectively entails understanding their affective needs and choosing examples that can motivate them to learn. Failure to understand their affective and psychological needs may breed resistance to learning that is usually shown through disruptive behaviour, lack of concentration, and paying attention to what is being covered in a lesson. A teacher's learner knowledge influences the choice of examples and the structuring of the learning concepts to a level that meets the learner’s needs. According to Ijeh and Nkopodi (2013:475), the Technology subjects are hierarchically cumulative disciplines in which learners' prior knowledge is central to the building of new concepts. The effective teaching of the technology subjects’ entails diagnosing learners' misconceptions and their origins, how learners construct knowledge, acquire new skills, and how to develop habits of mind that are aligned to Technology thinking and positive dispositions. The achievement of these aspects can lead to the connections of concepts in the same subject or across disciplines, selecting multiple representations of the concepts, choosing alternative teaching strategies aligned to the learners' different learning styles, and exploring alternative ways of looking at the same concept.

2.4.4 Pedagogical knowledge (PK)

Pedagogical knowledge is teachers’ deep knowledge about the processes and practices or methods of teaching and learning (Koehler & Mishra, 2009:64; Harris, Mishra & Koehler, 2009:397). PK consists of general classroom management strategies, course planning, and learner assessment (Sahin, 2011:99). According to Fernandez (2014:81) PK emanates from the recognition of professional knowledge of teachers who build knowledge in the classroom in contact with their learners that is distinct from the formal knowledge. A teacher with a deep PK of the subject matter understands how learners construct knowledge and acquires skills in

a differentiated manner and how they develop habits of mind toward learning (Harris, Mishra & Koehler, 2009:397). To reduce lots of impediments in the teaching of Technology, the researcher's point of view is that it is imperative for teachers to employ best practices in the classroom to vary instructional methods, motivate learners, promote active learning, evoke higher-order thinking and problem-solving skills, assess learner learning, and set expectations for learning. Technology teachers need the knowledge of strategies that are most likely to be successful in reorganising the understanding of learners (Shulman, 1986:9-10). Ijeh and Nkopodi (2013:475) attest that PCK is the ability of teachers to understand their learners and the pedagogical approaches that may suit them. On the other hand, the researcher believes that teachers holding PK are at liberty from the impediments faced in the teaching of Technology. Teachers' PK is important to enable them to interpret learners' learning styles and align them to pedagogical approaches that suit individual learners in a class.

The researcher is concerned that Technology teachers need to be aware of the impediments they face in the teaching of Technology in order to make pedagogically sound decisions. The researcher concurs with the fact that teachers' inadequate knowledge results in ineffective teaching of concepts in the classroom. Teachers should have a good grasp of the Technology concepts for learners to understand what they have been taught. Teachers who had to teach Grades 8 – 9 Technology classes for the first time in South Africa were ill-prepared as many were not formally trained to teach concepts and therefore lacked adequate CK (Gumbo, Makgato & Muller, 2012:25). Teachers who teach Technology concepts for the first time tend to rely mostly on textbooks as resources to teach the content. However, the teaching of Technology concepts is organised differently in textbooks, and sometimes the topic coverage is different. Different topic coverage refers to (in one textbook, the information is organised from concrete to abstract meaning that the content is elaborative enough to be easily understood by learners; in some textbooks, there is enough content coverage while others do not have) a choice of textbooks with enough content coverage Technology teachers use to facilitate meaningful learning in learners. In cases where teachers do not have adequate CK, this poses a problem for teaching as they might not know where to start teaching and how to approach the topic. Teachers might also not be aware of the available teaching resources for effective teaching of Technology Education. However, Shulman has included resources as one of his framework's pillars. However, Maluleka *et al*., (2006:508) argue that resources might be plentiful and that it takes teachers to turn their eyes from the Department of Basic Education's

provision to the immediate environments – indigenous environments are particularly rich in their own unique technological activities and resources.

2.4.5 Knowledge of general educational contexts

One of the elements of Shulman's theory is the knowledge of general educational contexts. The knowledge of general educational contexts, which of course teachers should be acquainted with, is important to be considered in the teaching practices. Teachers can be acquainted with the knowledge of general educational context which can further be classified into specific knowledge contexts to constitute knowledge of specific content, specific curriculum, specific pedagogy, and so on. In order for teachers to be more effective, they need to develop their knowledge on the premise of the aspects as well as the sound development of their PCK (Newsome & Lederman, 1999:21). According to Gumbo (2014:480), since the inception of Technology as the new curriculum in 1998, teachers face impediments in the teaching of Technology. A successful Technology teacher, who has the PK of the subject matter should have the following attributes for the PCK to teach learners:

- develop and apply specific design skills to solve technological problems,
- understand the concepts and knowledge used in Technology Education and use them responsibly and purposefully, and
- appreciate the interaction between peoples' values and attitudes, technology, society and the environment.

According to the researcher, for effective teaching, it is imperative for Technology teachers to possess a deep understanding and knowledge of content and pedagogy. Therefore, teachers cannot provide their knowledge to guide learner progress towards understanding whereas they themselves do not understand what is expected from them to teach the learners in context.

2.4.6 Knowledge of educational ends and purposes

Evaluation and assessment are the ongoing processes of collecting, synthesising, and interpreting information (Department of Education, 2011:5). According to Newsome and Lederman (1999:21) since assessment is integral to teaching and learning, the knowledge of educational ends and purpose cannot be separated from the knowledge about evaluation and assessment procedures. However, according to the researcher, teachers depend on assessment

for the improvement of their practices, and thus assessment needs to be continuous. 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 CK and knowledge of goals and assessment procedures. Notably, PK receives inputs from knowledge of learners or learning as well as knowledge of goals or assessment procedures.

According to the researcher's understanding, classroom assessments and learner evaluations are an important part that occurs throughout the teaching-learning process. Furthermore, it enables Technology teachers to determine their learning outcomes so that they can be able to devise some assessment strategies on how to approach sections which are difficult for the learners, to improve their performance. The assessment of learning plays a central role in the teaching-learning process of Technology. Tacoshi and Fernandez, (2014:124) regard knowledge of assessment as the strong link between knowledge of the educational ends, goals, purposes and values and the knowledge of assessment procedures. Dufee and Aikenhead (1992:494) concur that learner evaluation is an important issue for teachers in the adaptation of the new curriculum. Teachers should use assessment methods to find out what students have learned (Kind, 2009:177). According to the researcher, there are different forms of assessments and assessment activities that serve a variety of purposes within the educational framework. For example, formative and summative assessments can be used to assess the learner's progress. This knowledge is comprised of the knowledge of the dimensions that include knowledge of specific instruments, approaches, and activities (Park & Oliver, 2008:266).

According to the researcher, formative assessment is developmental and is used to inform teachers and learners about their progress. In addition, it is interactive in that the teacher uses thought-provoking questions to stimulate learner thinking and discussions. The summative assessment gives an overall picture of learners' progress at a given time, for example, e.g., at the end of a term. However, it usually results in judgments about learner performance and can involve high stakes for learners, (DoE, 2011:3). These varieties of assessment processes are intertwined to create synergy processes. In the researcher's opinion, learner assessment promises to be a fruitful area to find out more about teacher decision-making and teacher knowledge.

Pedagogical Content Knowledge covers the core business of teaching, learning, curriculum, assessment, and reporting, such as the conditions that promote learning and the links among

curriculum, assessment, and pedagogy (Koehler & Mishra, 2009:64). Ijeh and Nkopodi (2013:474) argue that content and PK are different aspects that are used separately in planning and teaching. Shulman (1987:12) refers to this knowledge as PCK. The professional development programmes often focus on developing teachers' knowledge and skills in understanding learners' technological work and thinking (Hill, 2008:373). In order to develop the understanding of PCK, Technology teachers need to have a rich conceptual understanding of the particular subject content that they teach. Novice teachers and experienced teachers, who have not taught a particular topic before, may have little or no PCK in that specific content area and the researcher might experience a lot of impediments in the teaching of the subject. On the other hand, "successful" teachers in a given content area, by which we mean those whose teaching in that particular content area promotes learners' learning, are likely to have well-developed PCK with fewer impediments in that specific content area (Fernandez, 2014:79). The researcher is of the opinion that if PCK as a construct is to be meaningful in Technology teachers' work and argues that it is important for concrete examples of PCK to be articulated and documented. Teachers can access and use them, in shaping their own teaching of the subject to alleviate the impediments faced by Technology teachers.

In the development of teachers' work in PCK, particular attention has been paid to the nature of teachers' knowledge that helps them to develop and apply teaching approaches that promote learners learning in ways other than "teaching as telling", i.e., seeking to better capture and "unpack" constructivist approaches to teaching (Loughran, Berry & Mulhall, 2012:16). In the researcher's opinion, effective or successful teaching and learning in Technology place the teacher in the role of the mediator of learning, in a sense that the teacher is not only knowledgeable about Technology concepts to teach learners but draws on this knowledge to shape teaching. In addition to the above statement, effective teachers monitor learners' understanding in ways that allow them to be responsive to learners' learning and create opportunities that help them to grasp the Technology concepts more fully under consideration. Obviously, this cannot be achieved by simply telling learners what they should think and why. A teacher's effective PCK is inferred in learners' ability to communicate reason, apply and transfer classroom content in various facets of their environments and other disciplines in the school curriculum.

2.5 THE KOLB MODEL OF LEARNING

This model of learning gives a detailed account of the theory of the subject under investigation. For teachers to be effective in their teaching strategies, it is imperative for them to understand CK and teaching practices. In this instance, CK refers to the knowledge about the subject matter that is to be learned or taught (Harris, Mishra & Koehler, 2009:397). Content Knowledge alone is not enough; PK becomes imperative which, according to Harris *et al*. (2009:397), 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 classroom settings. Importantly, a teacher with a deeper PK understands how learners construct knowledge and acquire skills in differentiated manners. As such, PK requires an understanding of cognitive, social, and developmental theories of learning and how they apply in the classroom setting (Harris, *et al*., 2009:397).

Kolb (1984:20) attests that individual experience is learning on the basis of concrete experiences, conceptualising experiences, working with ideas or concepts, or actively experimenting with or manipulating objects. Kolb (1984:30) organised cognitive styles under two domains namely, the concrete-reflective domain and 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 (adapted from Kolb, 1984)

CONCRETE – REFLECTIVE DOMAIN		**ABSTRACT – ACTIVE DOMAIN**	
Concrete experience	**Reflective observation**	**Abstract conceptualisation**	**Active experimentation**
Affective --- Dealing with people. --- Being sensitive to the values --- Being sensitive to people's feelings --- Working in groups.	**Perceptual** --- Gathering information --- Organising information --- Listening with open mind --- Seeing how things fit in the --- big picture ---	**Symbolic** --- Testing theories and --- ideas --- Analysing quantitative --- data --- Experimenting with new --- ideas ---	**Behavioural** --- Making decisions --- Seeing and exploiting of opportunities --- Setting goals Committing self to --- objectives ---

CONCRETE – REFLECTIVE DOMAIN		ABSTRACT – ACTIVE DOMAIN	
Concrete experience	**Reflective observation**	**Abstract conceptualisation**	**Active experimentation**
	Developing comprehensive plans --- Imagining implications for ambiguous situations	Designing experiences --- --- Generating alternative ways of doing things --- Building concept models	Able to adapt to changing --- circumstances --- Influencing and leading others

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 detail subsequently.

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 were discussed in the preceding section. The stages create synergy, which is necessary to reflect on the experience to make generalisations and formulate concepts that can be applied to new situations (Kolb, 1984:31).

2.5.1 Concrete experience

The concrete experience starts the learning cycle, and it unfreezes learners from their held perspectives (Kolb, 1984:31). 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 (1984:31), concrete learning can 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, teachers should have a wide experience in imparting knowledge to the learners, and this would be imperative to relate new learning information to past experiences. In the context of having the concrete experience, teachers should understand that it sets the stage for the learners' learning by engaging them on an affective level. The concrete experience assists learners to connect to the past and anticipate the future.

2.5.2 Reflective observation

In this instance, the learners address learning objectives from observation instead of action. Kolb (1984:32) 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". 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, see possible implications and think broadly about the meaning of things.

As a Technology teacher, it is important for one to self-reflect after an event or class session through for instance a logbook to record occurrences, and to use peer evaluation to get learners feedback, which will give an overall reflection on one's 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 the teachers' insight into the ways to teach better. One may have twenty-five years of experience, which may consist of teaching the same content the same way. This could tell that the teacher has not been doing any self-reflection. In this instance, unless there is a reflection on 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 to the development of teachers, and 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.

2.5.3 Abstract conceptualisation

According to Kolb (1984:32), with abstract conceptualisation, learners usually develop and act on an 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, 1984:32). 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, teachers should be well versed in educational theories and attend staff development interventions. By so doing, teachers are likely to draw conclusions from their practices.

2.5.4 Active experimentation

This element is all about the actual execution of activities within a learning environment (Kolb, 1984:34). In this case, learners in conjunction with the teachers come up with ways to solve real-life problems and make decisions. According to Kolb (1984:34), 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.

2.6 SANDER'S TEACHING COMPETENCE MODEL

For the purpose of this study, the framework of Sanders (2008) will be followed, which defines PCK as one's knowledge of how to teach a particular subject content in a specific context as shown in figure 2.2.

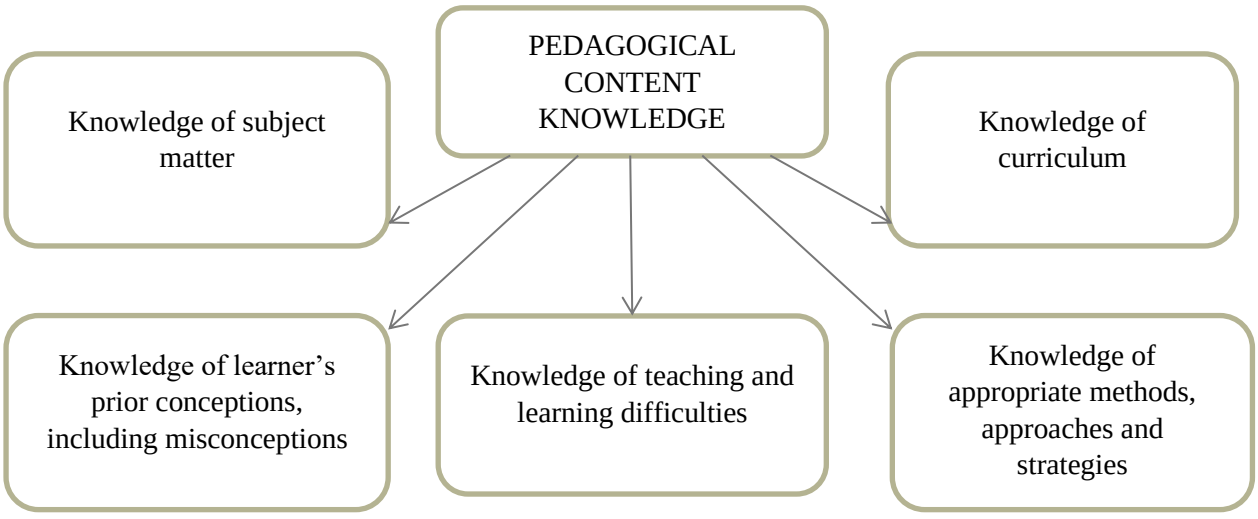


Figure 2.2: Five sub-category model of PCK (adapted from Shulman by Sanders, 2008).

Sanders (2008) modified Shulman's construct of PCK by identifying knowledge in three different ways which intersect with PCK at the core. Firstly, Shulman's category of "subject

matter knowledge" was added as a sub-category to PCK. This was necessary because Shulman says that PCK is about the knowledge of matters associated with the teaching of a particular topic, and in order to teach any topic teachers should have the knowledge of the particular subject content. Secondly, based on the same reasoning, Sanders included Shulman's category of curricular knowledge as a sub-category under PCK because curricular knowledge about a particular topic is essential to the teaching of that particular content.

According to Pirttimaa, Husu and Metsarinne (2017:215) in the learning process, there are different types of knowledge that have their own specific features and activities that enable teachers to be effective in the teaching of Technology. Technology teachers should embrace the five sub-category models that can assist in alleviating the impediments faced by teachers in the class environment. Kind (2009:169) argues that the development of PCK may assist inexperienced teachers to adjust to teaching as well as help skilled teachers in developing more reflective practices openly in the teaching education process. Each of the categories in figure 2 is discussed in the next sub-sections.

2.6.1 Knowledge of curriculum

To ensure learners' success, it is imperative for Technology teachers to conceive the curriculum in different ways to meet the learners' needs and to ensure effective teaching. During professional development, known as the formal training of teachers, Technology teachers adopted the curriculum in different ways that are influenced by the current teaching and the content to make decisions on all aspects of teaching (Dufee & Aikenhead, 1992:493). Gumbo and Williams (2014:479) add that helping the learner to learn means that the teacher has enough of curricular knowledge and PK that goes deeper than mere teaching of the subject content. This simply means that Technology teachers should possess the knowledge and skills to enable them to deal with the impediments that they face in the teaching of the subject. A Technology teacher who has curriculum knowledge can modify the content by utilising different methods and strategies to assist the learners in achieving the learning outcomes. According to Brown, Ernst, Clark, DeLuca and Kelly (2017:31), it is imperative for teachers to gain some insights into understanding the skills for teaching Technology. Furthermore, Dufee and Aikenhead (1992:194) suggest that from past experience, teacher knowledge consisted of three major components which are teachers' past experience, teachers' current teaching situation, and teachers' visions of how the teaching situation should be.

2.6.2 Knowledge of teaching and learning difficulties

Sanders (2008) expanded the sub-category of learning difficulties by including difficulties that teachers may encounter when teaching Technology. The researcher referred to PCK in the sub-category of learning difficulties as associated with impediments that teachers might face when teaching Technology. Christiansen, Betram and Mukeredzi (2015:10) concur that teachers need to be aware of the difficulties this causes, so they can take the appropriate steps to deal with the potential controversy. In the researchers' point of view, it is imperative for Technology teachers to develop PCK in order to do away with the impediments they face during teaching practice.

2.6.3 Knowledge of the learners' understanding of technology

This category deals with the learners' characteristics on how they react to what they are being taught. Learners also become actively involved in the lesson if the teacher considers the prior knowledge that permits them to use their background knowledge to construct meaning from new ideas and concepts. For learners to understand the content easily, depends on the intellect the learners possess. Learning is guided by the degree of intellect they possess (Brown, Ernst, Clark, DeLuca & Kelly, 2017:31). The active participation of learners involves hands-on activities during Technology lessons that incorporate high-order thinking skills, problem-solving, application of concepts, and decision making. Hands-on activity is an appropriate approach that is an effective basis for learning in Technology lessons (Korwin & Jones, 1990:2). In this category, learners cannot fully understand the Technology concepts without including problem-based learning that leads them towards finding solutions for their activities (Asunda & Mativo, 2017:9).

2.6.4 Knowledge of instructional strategies

This category requires that the teacher map out learning activities and teaching practices that will facilitate comprehension of the worthy concepts of the lesson (Asunda & Mativo, 2017:11). According to the researcher, learners learn best in a conducive environment to enable them to work at ease. To eradicate the impediments faced by Technology teachers, it is important for them to engage in different delivery methods to assist learners to understand the subject matter. It is also vital to introduce the lesson by using the prior knowledge of learners

to encourage them to utilise their thinking skills, strengths, learning styles and background knowledge to solve problems in an active manner. It is important for Technology teachers to understand that every learner is unique, hence, they learn differently and at their own pace. For learners to be successful in Technology Education, teachers must encourage learners to do hands-on activities to provide active learning opportunities for learners rather than receiving passive knowledge. A continuum of cognitive development was developed by Jean Piaget who believed that a child could construct a more permanent knowledge base by experiencing something rather than just being told (Korwin & Jones, 1990:3). Technology teachers with the knowledge of teaching strategies and presentations understand how learners think and the way in which they learn. In addition, Technology teachers have the ability to teach in a way that makes connections between the learner's prior, current, and future knowledge (Maniraho, 2014:22).

2.6.5 Knowledge of learners

Learners become involved in the lesson if the teacher considers the prior knowledge that permits them to use their background knowledge to construct meaning from new ideas and concepts. Hands-on activity is an appropriate approach for effective teaching and is important in the education process. The classroom environment is the most important aspect to be introduced to learners. It is imperative for Technology teachers to create a positive learning environment by communicating expectations in a Technology classroom. Class rules should also be made clear to be understood by learners. According to the researcher, the knowledge of learners is a component that may include their academic strengths and weaknesses.

2.6.6 Knowledge of assessment

Continuous assessment plays a vital role in assisting Technology teachers to understand whether the learners are on track with what they have been taught or not and to determine the areas of development. Technology teachers need not only to understand what to assess but it is also important to know how to assess, including both the lower and higher-order questioning (Magnusson Krajcik & Borko, 1999). In the researcher's opinion Technology teachers need to have knowledge of assessment and to understand different methods and strategies to be used during the assessment.

2.7 CONSTRUCTIVISM

The elements of both the teaching competence model and constructivism are combined and used as a way of explaining some of the practices teachers use in the daily teaching of Technology. Constructivism implies that learners are encouraged by their teachers to construct their own knowledge in real-life situations with others instead of informal situations where they actually work on their own (Van Wyk & Alexander 2010:161). In this regard, learners build new knowledge on the basis of their previous learning experience (prior knowledge). More importantly, the 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 (1993:14) attests that "to be competent technological problem solvers and to use problem-solving effectively as an instructional methodology, pre-service Technology Education teachers should participate in order to acquire the skills needed".

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 the most important principle of constructivism. This theory becomes important for the teachers faced with impediments in the teaching of Technology to understand, in order for them to be able to implement the teaching practices effectively. In the end, Brown *et al*., (2017:33) beliefs are articulated as:

- 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 the 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.
- 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 project-based learning whereby learners will be given some assignments and should essentially come up with solutions or answers.
- Learners should be afforded the opportunity to seek solutions before the teacher shows them the way to solve such problems and

- For learners to think independently, they should be given a chance, which is more vital than specific curriculum content.

For their independent thinking process, it is believed that teachers regard learners as active participants in the learning process of gaining knowledge, compared to where the teacher's role is seen as that of dissemination of information to the learners (Talis, 2009:90). More emphasis should be put on the independent thinking of learners by Technology teachers in ensuring that learning is well constructed, which calls for thorough preparation for a learner-centred approach, which gives learners an opportunity to learn on their own and at their own pace. Teaching practices could be improved and as such learners would fare much better if teachers are using this model, compared to the conventional way of teaching where the teaching strategy is more teacher-centred

Chigona, Chigona, Kayango and Kausa (2010:22) confirm 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". This means that the reasoning capacity, understanding and creativity of learners are increased. In this regard, constructivism as an approach to teaching promotes higher thinking skills and better problem-solving strategies. According to Chigona *et al.*, (2010:22), this approach allows teachers to focus on critical activities such as (annual teaching plan), programme of assessment, lesson planning and other relevant activities.

The foregoing discussions show the ramifications of PCK in other later works. There are therefore connections between these frameworks which provide a consolidated framework for this study. These are depicted in figure 2.4. Therefore, continuing with the study, this framework helps to frame the exploration of the impediments that Grades 8 – 9 Technology teachers face.

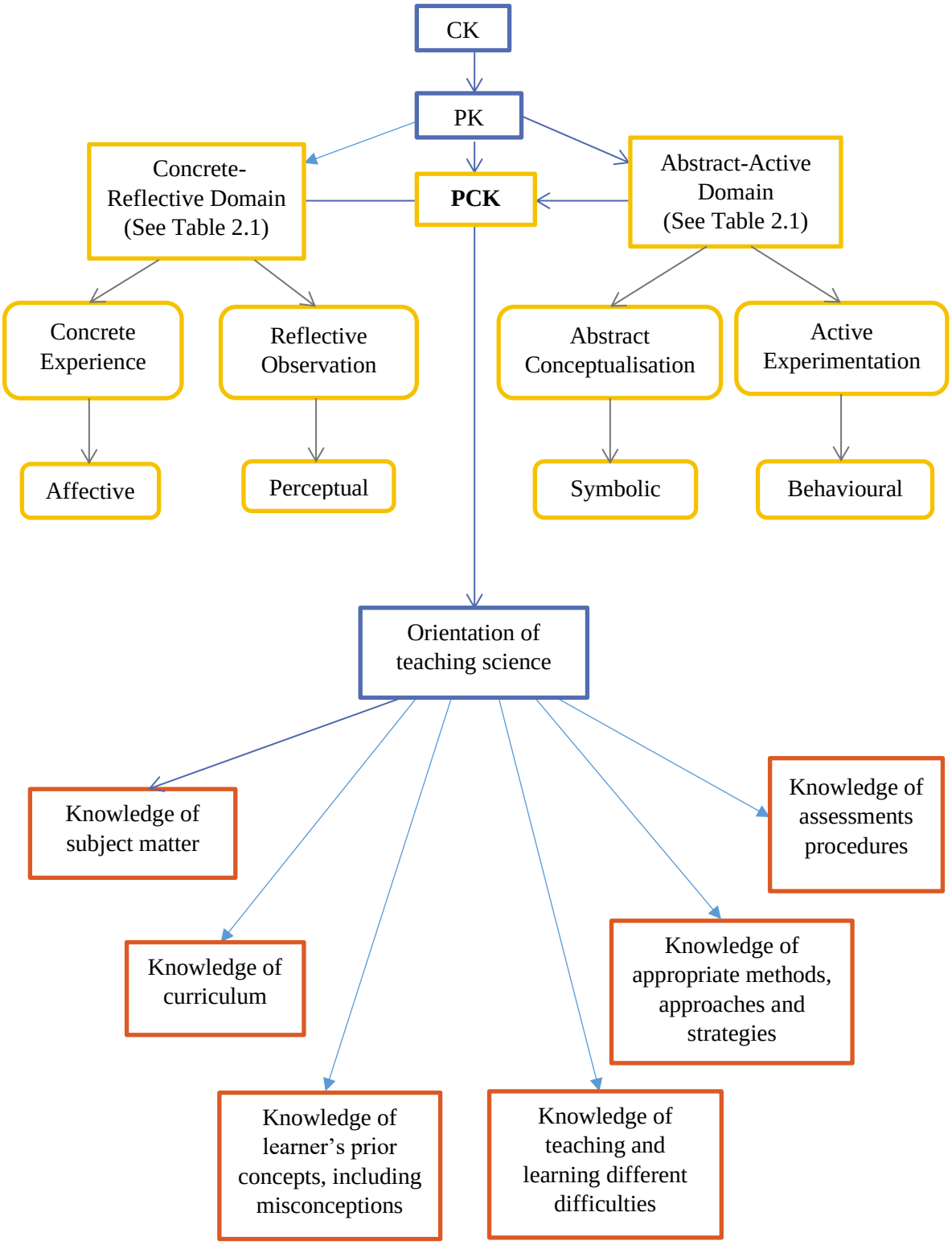

CK
PK
PCK
Concrete-Reflective Domain (See Table 2.1)
Abstract-Active Domain (See Table 2.1)
Concrete Experience
Reflective Observation
Abstract Conceptualisation
Active Experimentation
Affective
Perceptual
Symbolic
Behavioural
Orientation of teaching science
Knowledge of subject matter
Knowledge of curriculum
Knowledge of learner's prior concepts, including misconceptions
Knowledge of teaching and learning different difficulties
Knowledge of appropriate methods, approaches and strategies
Knowledge of assessments procedures

Figure 2.4: Pedagogical Content Knowledge and Components of Domains for Technological Knowledge for teaching.

In the quest to ensure that PCK is effective, there should be an interconnectedness between the components. In order to emphasise the interrelatedness and integration among the components, PCK is the centre of the model. These essentially mean that the development of one component could at the same time encourage the development of others, and ultimately enhance PCK. However, PCK that comprises effective teaching needs the integration of all the components that is deemed to be the contributors to PCK. It is only when teachers are able to integrate all the components of PCK and apply them at the right time for the right learners in the right context that effective teaching will occur (Park & Oliver, 2007:264). In the case of lack of coherence among components, there is the likelihood of encountering problems in the development of PCK, and increased knowledge of a single component may not be sufficient to stimulate change in practice. In the envisaged framework, the researcher has added a new component to the model.

It is important for Technology teachers to acquire CK when presenting the lesson as it is the first category that includes the knowledge of the subject. It is also imperative to understand the subject matter and teaching practices in a sense that it enables them to be considerate. Shulman (1986:8) assert that mere CK is likely to be as useless pedagogically as content-free skill. Content Knowledge further helps Technology teachers to understand and apply appropriate methods, approaches, and teaching strategies. Content Knowledge is not enough for teachers' knowledge, but to have a thorough understanding of the subject. A teacher with PK requires a thorough understanding of how it applies in the classroom setting (Ball, Thames & Phelps, 2008:391).

In the context of the above, Kolb (1984:30) proposed cognitive styles under two main domains namely:

- the concrete-reflective domain and
- the abstract-active domain.

The two cognitive styles are informed by the PK and should therefore be followed in sequence for effective teaching and learning of Technology Education to take place. The cognitive styles consist of four components, two from each domain. In the learning cycle, the first domain consists of concrete experience and reflective observation. A Senior Phase Technology teacher (Grades 8 – 9) who possesses all these attributes is likely going to determine the impediments they are facing and come up with strategies on how to overcome them.

In the **Concrete experience component**, Kolb (1984:31) asserts that it unfreezes learners from their available situation. In addition to that, the learning style assists learners to perform other tasks independently. It is imperative for Technology teachers to understand how to disseminate new learning information to learners and to assist them to connect from the past to anticipate the future.

Reflective observation component: In this component, learners learn through observation instead of action from their experienced Technology teachers. It is important for Technology teachers to reflect on what they have learned from peers and to impart that information to learners and therefore use peer assessment to receive learners' feedback. Through teachers' reflection on their teaching, the feedback at the end of the assessment process will give them the opportunity to determine whether they are on the right track or not. Reflective observation also takes an important role in improving the teachers' activities in the classroom and enables them to teach better from the experience of the teaching and learning process. According to Kolb (1984:32), the component refers to the daily experience of novice Technology teachers who are not competent enough to teach the subject.

The second domain consists of abstract conceptualisation and active experimentation. In **Abstract conceptualisation**, this component encourages creativity among learners. Learners should attempt to give out what they have learned in their previous experiences. In this instance, learners are given the opportunity to perform what is best while teachers serve as facilitators and give guidance where possible. For learners to understand and develop the knowledge and skills needed in Technology, they should be involved in active participation in class (Kolb, 1984:32). To produce abstract conceptualization, it is imperative for Technology teachers to be well versed in a variety of knowledge and to attend enrichment workshops. Ultimately teachers will be able to determine their progress in their teaching practices.

Active experimentation, this component deals with the integration of activities by learners within the learning environment whereby they are encouraged to solve real-life situations with the guidance of their teachers (Kolb, 1984:34). In an active experimentation, participation is more on action than theory in an attempt to apply new knowledge in another environment.

The amalgamation of the two cognitive styles forms the PCK which enables teachers to determine how impediments affect Technology teachers' practice. Orientation of science is informed by PCK with the six categories. The above proposed conceptual frame is in line with the research questions and the objectives of the study. In order for the teachers to be more effective in Technology class, they should be conversant with knowledge of the subject matter, have expert knowledge of the curriculum, learner's prior knowledge, knowledge of learning different difficulties, knowledge of appropriate methods and strategies and lastly, they should have knowledge of assessments procedures and methods. Measurements will be done on those six constructs. It is therefore assumed that a teacher who completed teachers' qualifications should understand the six categories, which serve as pillars for effective teaching of Technology. The six categories of teachers' knowledge will assist the researcher in formulating the research questions and to collect much of the data from participants on how these impediments affect their teaching.

In the above framework, the researcher intends to explore the interrelatedness of PCK with knowledge of teaching and learning different difficulties as a missing paradigm in research on teaching compared to other categories. The category was discovered as a gap to be researched in Technology Education in order to explore the impediments faced by Grades 8 – 9 Technology teachers, to determine how they affect their teaching and how to overcome them. Data will be collected based on the teaching and learning of different difficulties experienced by Technology teachers that hinder the effective teaching of the subject.

2.8 INTERCONNECTEDNESS OF THEORIES AS WELL AS HOW THEY ARE USED IN THE STUDY

The three selected theories' (Kolb's Model of learning, Sander's teaching competence model, and Newsome and Lederman) feature interconnect in relation to the use of PCK. In the quest to ensure that PCK is effective, there should be an interconnectedness between the components of theories. In order to emphasise the interrelatedness and integration among those components,

PCK becomes the centre of the ultimate theory. These essentially mean that the development of one component could at the same time encourage the development of others, and ultimately enhance PCK. However, PCK that comprises effective teaching needs the integration of all the components that are deemed to be the contributors to it. The theories connect to each other through the following components: knowledge of the subject matter; knowledge of curriculum; knowledge of learners' prior conceptions including misconceptions; knowledge of learning and learning difficulties; knowledge of appropriate methods and approaches. The components can be defined as one's knowledge of how to teach a particular subject content in a specific context.

The theories and their components are used in the study to respond appropriately to the research questions in terms of the impediments that Technology teachers face. The researcher opines that for teachers to be able to identify and manage the impediments, they should possess good subject matter knowledge to impart it effectively to the learners. They should have the classroom and good teaching experience to play an important role in the process of teaching and to handle the learning activities effectively. Technology teachers who are self-confident have the great possibility to teach the subject matter effectively and successfully.

2.9 CONCLUSION

The literature pertaining to the theories framing this study was discussed in detail in this chapter in reference to Technology teachers' impediments in teaching the subject. The theories discussed in this chapter include the five sub-category models of PCK, categories contributing towards PCK, components of domains, and the five components of PCK. Towards the end of the chapter the terms which are contained in these theories are used to show how the theories connect with each other. This has essentially replaced the traditional way or methods of teaching and attempts to develop learners to work in groups. Furthermore, there was a discussion on technology literacy which relates to one's ability to use, manage and understand Technology in full. Learners would be comfortable using Technology, once there is a full understanding of what technology literacy is all about.

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 a brief of the subject matter instead of giving details. Pedagogic content knowledge as a concept was also discussed in detail and involves its

definition which relates to teachers' interpretations and transformations of subject matter knowledge in the context of facilitating learner learning. Furthermore, followed Shulman's elements contributing to PCK and were discussed. Constructivism as a theoretical model was also outlined in detail, 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. The five principles in the theoretical framework helped me realise that my study focused on its use, and therefore to assist in designing the research questions.

CHAPTER 3

TECHNOLOGY EDUCATION AND RELATED PERSPECTIVES

3.1 INTRODUCTION

The process of educational development to train teachers for the implementation of Technology Education as a subject in schools started after South Africa got liberated from the apartheid regime in 1994. To become a professional teacher, Technology teachers had to undergo continuous professional teacher development (CPTD) so that they could provide quality education to the learners. The purpose of Technology Education is to provide all learners with the knowledge, skills, and abilities to function effectively in a technological world. Teachers should be developed in this subject to gain experience of what exactly transpires in the classroom as they are still faced with challenges in the teaching of Technology. It is important for teachers to understand how they teach and what impediments they do come across in the teaching of Technology. Therefore, it is necessary to understand the impediments faced by Technology teachers in the Nkangala Sub-District so that they can be addressed to provide effective teaching to learners.

In light of the above, this chapter presents the discussion on the impediments that teachers face in the implementation of the curriculum. Key issues discussed include, among others, Technology teachers' shallow understanding of curriculum, Technology teachers' underdeveloped PCK, understanding of Technology and Technology Education as a subject, and teachers' lack of self-efficacy in the subject.

3.2 TECHNOLOGY TEACHERS' SHALLOW UNDERSTANDING OF CURRICULUM

3.2.1 Curriculum review: A cause for impediments faced by Technology teachers

The impediments facing Technology teachers can be understood against the changes that took place in the curriculum soon after South Africa entered the era of democratic ruling in 1994. Outcomes-Based Education (OBE) was introduced in South Africa in 1998 through C2005. It

was however reviewed in 2000 because of, among other reasons, difficult terminology that the teachers had to contend with. Even additional changes followed in 2002 to make the curriculum more user-friendly. The change even resulted in the renaming of the curriculum from C2005 to National Curriculum Statement (NCS) and shortly thereafter to the Revised National Curriculum Statement (RNCS). The revised National Curriculum Statement became official policy in 2002 scheduled for implementation in 2004 (DoE, 2002). Another curriculum review process was initiated in 2009 for implementation in 2010 (Mapotse, 2012; Mapotse & Gumbo, 2012). This review produced the current CAPS. The RNCS remains a policy, while the CAPS is an attempt to give clear guidelines on the implementation of NCS (Mapotse, 2014:214). The changes reflected in CAPS aimed to relieve teachers and schools of some of the challenges (Moodley, 2013). The following changes are noted (Moodley, 2013:36):

- development of syllabi for implementation in 2011,
- discontinuation of the use of portfolios from 2010,
- reduction of the number of learning areas in the Intermediate Phase,
- emphasis on the use of English from as early as possible for the majority of learners,
- that use English as the language of learning,
- requirement of only one file for administrative purposes from teachers,
- clarification of the role of subject advisers in the curriculum delivery, and
- reduction of the number of projects required by learners.

According to Moodley (2013:36), these changes would free up more time for teaching and learning and the report recommended targeted support for teachers and schools. In addition, changes included the easing of terminologies such as educator to the teacher, learning area to subject, outcomes to aims and objectives and curriculum to the syllabus (Department of Basic Education [DBE], 2011). When following C2005, there were s of some prominent problems that were likely to exist still. Garfield de Waal (2004:50) also observes that Technology teachers had not yet reached the required level of understanding of C2005/OBE and some of the problems were identified, which include:

- Complex language and confusing terminology used in the new curriculum framework. The language in the policy document is difficult to understand. As a result, teachers cannot see how OBE can be implemented in the classroom. Also, new words are used to replace the old ones. For example, “teachers” are replaced with the word “educators”.

- Curriculum overloading: The original version of C2005/OBE had many design features. There are Learning Areas, Learning Programmers, Critical Outcomes, Specific Outcomes, Assessment Criteria, Range Statement, Performance Indicators, Phase and Programme Organisers. Another feature added to C2005 was Expected Level of Performance. Teachers spend so much time trying to include all these features in their planning that they do not spend enough time on reading, writing, and mathematics, and core concepts in Technology.
- Progression and integration: The original C2005/OBE encourage teachers to combine knowledge from different subjects. That is, it encourages integration, but it does not give enough guidance on what to teach when to teach it, and at what level to teach it. As a result, learners are often taught the same concepts, at the same level, repeatedly. They do not learn the skills and knowledge at the different levels that they should and therefore there is little progression.

These changes still affected Technology Education and teachers' coping demands to a large extent on both subject content and PK (Mapotse, 2014:214). The implementation of Technology Education was thus unsatisfactory and was neglected in many schools, and in others, the lessons were spent studying physics or doing metal work (Riis, 1996 in Nostrom, 2014:13). On the other hand, teachers who understood the change in the subject were allowed to implement the Technology Education curriculum in schools as well as new planning methods and assessments and the general use of resources and materials to support the implementation (Sedio, 2013:1). Therefore, a lack of knowledge and understanding of curriculum change could be an impediment to the success of curriculum implementation by Technology teachers. For example, impediments regarding assessment emanate from a lack of knowledge on how to manage and record assessments in the classroom. It is imperative for teachers to understand how assessment is done in Technology Education and the content for teaching to become effective in a Technology classroom.

The curriculum review explicated above emphasised the impediments that Technology teachers encountered during the implementation of the subject. Tshiredo (2013:3) posits that in South Africa, the implementation of curriculum changes was mainly focused on the desired educational and political achievement than on how implementation should take place. As partly cited above, the serious impediment facing Technology teachers, in general, could be the lack of successful translation of new curriculum reforms into classroom practice and this could

result in teachers not being effective in the classroom. The question is: How can Technology teachers teach the subject effectively while they struggle with the understanding of and implementation of the curriculum in the first place?

The majority of Technology teachers found the initial curriculum change (C2005 to RNCS) to be very complicated, confusing and demoralising with many new terminologies and content to be learned per phase and not per grade (Mapotse & Gumbo, 2012:542). The struggles that Technology teachers experience are evidence that the problem remains despite the efforts taken by DBE to address some of the impediments in the now CAPS. Furthermore, it is observed that the above curriculum changes were accompanied by factors such as fear, demotivation, stress, resistance, and disempowerment, which proved to be detrimental to the success of Technology Education (Mapotse, 2015:214).

Teacher preparation is therefore important for the successful implementation of the above changes. An effective education system aims to develop teachers who are committed, competent, and confident in accomplishing these reforms (Dichaba & Mokhele, 2012:249). One of the main issues is the continuing professional development of teachers, which requires that teachers learn new roles and ways of teaching that translate into the long-term developmental processes that require them to focus on changing their practices (Dichaba & Mokhele, 2012:249). It is imperative for teachers at Nkangala Sub-District to be professionally developed for effective teaching in the classroom. Furthermore, teachers should possess enough curricular knowledge and PK to teach Technology to help learners understand and learn the subject successfully.

3.2.2 Impediments associated with Technology Education curriculum implementation

Mkandawire (2010:7) affirm that Technology teachers and learning institutions are faced with impediments that hinder the effective implementation of the subject. In addition, curriculum implementers such as teachers, headteachers, standard officers, and others are faced with impediments that hinder the successful implementation of the curriculum (Okello & Kagoire, 1996:124). Curriculum implementation is also hindered by what is going on in the learning institutions. Technology teachers' effective teaching is determined by learners mastering the intended outcomes (Ableser, 2012:68). In the researchers' opinion, it is important for teachers

to encourage effective teaching in the classroom by focusing less of their time on instructional teaching to ensure that more of the time is spent on learners' learning, which allows a child-centred approach to take place. According to Mkandawire (2010:8), there are several factors associated with impediments to curriculum implementation, and those are:

- inadequate learning facilities: unavailability of school facilities and equipment is an impediment in the learning institutions and thus, curriculum implementation is affected negatively,
- lack of quality and quantity of staff: the quality and quantity of teaching staff to meet the expectations of learners and the society is another impediment,
- poor conditions of service may affect curriculum implementation: poor conditions of services for curriculum implementers are another impediment to curriculum implementation. Employers such as the teaching service commission need to ensure that teachers are well paid and on time so that curriculum implementation is not hindered by all means. When curriculum implementers have lower salaries, no housing units, unpromising job security, poor transportation, and generally poor conditions of service it may be a serious impediment to curriculum implementation as they would resort to going out in search of resources to sustain their families. Some teachers may even resort to going into private commercial enterprises to supplement their salaries,
- inadequate financial resources and funding: it is an impediment if the education system has limited financial resources that make teaching difficult for teachers to implement curriculum effectively,
- lack of teaching and learning: inadequate teaching and learning resources can be a serious impediment to curriculum implementation,
- lost time for learning due to other activities: poor management of time leads to loss of learning time by school administrators and teachers, which is another impediment to curriculum implementation, and
- poor monitoring and evaluation of schools: it is imperative that educational officials visit schools to maintain standards and remind school authorities of their primary mandate in the education section.

Though Nokwali, Mammen and Maphosa (2015:563) are not wholly focused on Technology Education, they make a valuable claim that the implementation of Technology Education

brought numerous impediments that affected the teaching and learning of the subject, such as lack of time, lack of space and inadequate resources. According to Okello and Kagoire (1996:124), curriculum implementation "is a network of different activities involved in translating curriculum designs into classroom activities and changing people's attitudes to accept and participate in these activities". Some teachers' failure to interpret and implement the curriculum result in serious effects such as the backwash effects on national examinations (Mkandawire, 2010:2). It is for these reasons that the researcher argues that Technology Education may not be implemented successfully under these conditions, hence a need for the current study, which can help to illuminate the impediments that Technology teachers in Nkangala Sub-District face. Although the subject has been around for more than two decades, Technology teachers are still battling with teaching it successfully.

Gumbo and Williams (2014:479) confirm that a Technology teacher who has a deep understanding of the curricular knowledge and a thorough understanding of the subject possesses knowledge and skills that distinguish him/her from less experienced teachers. This means that Technology teachers who have developed the PK of the subject are likely to experience less of the impediments in their teaching of the subject. Nokwali *et al*., (2015:565) further emphasise that the implementation of Technology Education in South African schools needs basic space for preparation such as teacher training, assessment, improvement of the teaching environment, provision of teaching and learning materials, and departmental support for teachers in the classrooms. This imperatively suggests that teachers should receive adequate training and should be provided with learner-teacher support materials (LTSM) to be effective in a Technology classroom. Gumbo (2018:129) reveals the impediments that contribute to the poor understanding of Technology regarding lack of monitoring to offer advice and assistance by senior teachers and regular meetings for Technology teachers as well as insufficient funds. Makgato (2014:3688) argues that it is the responsibility of DoE to produce teachers with a deep understanding of teaching and learning of Technology by ensuring that the teacher education and training are intensified.

3.2.3 Professional development for the successful Technology Education curriculum implementation

The Continuous Professional Teacher Development (CPTD) programme aims to address the impediments faced by teachers in the teaching of Technology and establish their understanding

of concepts that they encounter in their teaching. The CPTD focuses on developing teachers' knowledge and skills to make learners understand technological work and thinking (Hill, Ball & Schilling, 2008:373). It is intended to equip teachers to be technologically literate so that they can function within Technology as a subject. Furthermore, the programme is intended to assist teachers in implementing Technology effectively and to familiarise them with the content. Makgato (2014:3688) posits that the introduction of Technology as a school subject happened suddenly as an urgent need for in-service Technology teacher training as part of teachers' professional development. Hence, there has been a lack of in-depth training for teachers in the subject. The nine provincial Departments of Education were responsible for executing the national policy by providing training for officials (Sedio, 2013:4) who are the Curriculum Implementers (CI's) responsible for presenting the teacher-training workshops in each provincial department. This suggests that the CI's should have a common understanding and vision of what curriculum should achieve, hence they are the drivers thereof (Nokwali *et al.,* 2015:564). It is for this reason that effective teacher training is an important pillar for the successful implementation of Technology. Furthermore, for teachers to qualify in the teaching of the subject, it is imperative for them to acquire mental and professional readiness as well as preparedness that are the requirements to implement Technology Education effectively (Nokwali *et al.,* 2015:564). Dichaba and Mokhele (2012:249) affirm that for Technology teachers need to have academic content and high-order thinking skills to be effective in their teaching.

Continuous Professional Training and Development (CPTD) has now been recognised as important to improve the quality of teaching and learning in schools. According to Engelbrecht, Ankiewicz *et al*., (2007:581), CPTD can be defined as continuous education and training for teachers who are already in the teaching field intending to assist them in the school environment to keep up to date with the rapid curriculum changes. According to Engelbrecht *et al*., (2007:4), CPTD can be defined as ongoing education and training for practicing teachers to assist them in keeping up to date with the rapid and numerous changes taking place in the school milieu. Engelbrecht *et al.,* (2007:8) deduce the advantages of the CPTD programme that contribute to the quality of education in the classroom thus:

- School-focused CPTD contributes directly to the improvement of the quality of education of the teacher and school,

- Collaboration between colleagues, principals and school management team and support for the training contributes to the professional growth of the teacher and promotes transformation,
- The principal/school should have the ability to motivate teachers to become actively involved in this training, and
- Teachers are allowed to be trained in curriculum development.

The above advantages are imperative to the CPTD programme, hence they assist in illuminating impediments faced by Technology teachers in the classroom. Furthermore, the advantages are important in assisting teachers to be well versed in various themes of Technology. Engelbrecht *et al*., (2007:581) explain that the CPTD is aimed at developing all stakeholders such as classroom teachers, seniors, administrators and school principals from all levels in educational services for implementing Technology effectively. Gumbo, Makgato and Miller (2012:24) define professional development as "the development of a person in his/her professional role".

Continuous Professional Training and Development are also necessary for response to a continuously changing education environment. Parttimaa (2015:216) attests that teachers participating in a Technology course have significantly increased their technical vocabulary. According to the researcher's point of view, CPTD is responsible for the upgrading of teachers who are already in the teaching field to a continuously changing education environment to develop their knowledge and skills. According to Engelbrecht *et al*., (2007:3), in the CPTD programme every CI was responsible for the training of teachers from each province. The CPTD programme had to take place within a very unrealistic period and in instances whereby Technology teachers were generally not trained enough to teach the subject. Engelbrecht *et al*., (2007:5) state that the CPTD programme serves two main purposes, which are to equip Technology teachers with knowledge for them to be successful in their teaching profession, and to develop qualified teachers within a specific content area.

Teachers were not given enough CPTD by the Department of Education (DoE) in assisting them to continue with Technology Education (Engelbrecht *et al.*, 2008:9). Therefore, teachers are ill-equipped to function within Technology and lack the necessary conceptual and procedural knowledge. The curriculum was open to different interpretations and many teachers

found it unclear and hard to understand (Norstrom, 2014:13). According to Heymans (2007:43), there were a variety of challenges facing the implementation of Technology Education which resulted from teachers not being fully equipped through training to teach Technology in schools.

In the light of the above, the implementation of Technology Education posed many challenges that resulted in the impediments that hinder its successful implementation. A good number of teachers have been trained in Technology Education. However, most teachers are unlikely to understand the meaning or have knowledge of its origins. According to Engelbrecht *et al.,* (2007:7), the effective implementation of the CPTD programme should focus on the following factors:

- training should be aimed at the needs and expectations of the teacher,
- training should be practical,
- training should occur continuously,
- training should give teachers the opportunity for professional development and growth,
- although the education authorities are not involved in the training which could result in training becoming isolated, the higher education institutions' quality control of this model will prevent this isolation, and
- the school management must be informed and supportive.

Engelbrecht et al., (2007:7) further confirms that the most effective efforts for change to take place close to the action, are concrete teacher-specific practices that are focused on practical problems, involve the teacher in project decision, include classroom assistance and have regular meetings that focus on practical problems. The CPTD programme that has not been managed properly and not completed to fulfil the immediate and specific needs of the programme might be regarded as being inadequate to overcome impediments in the teaching of Technology. Technology teachers in Nkangala Sub-District will continue to face the majority of impediments and could remain ineffective in their teaching due to a lack of curricular knowledge. Teachers who teach Technology without understanding the use of pertinent concepts related to it will be ineffective in teaching the subject.

Fox-Turnbull (2019:1133) states that the initial introduction of a professional development programme for teachers was to guide interactions with learners and to assist them with the ability to teach Technology effectively by giving feedback to learners. Gumbo and Williams (2014:479) state that teachers need to have a good relationship with the learners and understand their strengths, weaknesses, interests, and the need to transform a classroom into a conducive learning environment where learners can feel welcome, safe and respected, and where their inputs are valued. Furthermore, it is also an impediment for teachers to teach Technology without a pedagogical understanding of concepts and understanding of learners' learning.

Other impediments experienced by Technology teachers resulted from the inadequate training of teachers, hence they are ineffective in teaching the subject as they have a shallow PCK of the subject. It is imperative for Technology teachers to receive quality training and also equip themselves by enrolling with higher institutions. A concern has been raised that the Higher Education and Training sector and colleges were not adequately involved in the training process (Engelbrecht *et al.,* 2007:851). Hence, a lack of knowledge of the Technology concepts created a barrier to self-confidence in teachers to teach the subject. Engelbrecht *et al.,* (2007) and Makgato (2014) posit that the inadequate training of Technology teachers made teaching difficult for them, which resulted in one the impediments in the teaching of the subject.

Technology teachers experienced problems with the amount of training they received, the quality of the trainers, and the lack of learning support materials (Selesho & Monyane, 2012:111). The CI's were also not sufficiently trained in the teaching and learning of Technology, hence, teachers received insufficient and poor-quality training in the subject (Makgato, 2014:3689). Gumbo (2016:2) attests that during the inception of Technology Education as part of C2005 in 1998, there were no trained Technology teachers to teach the subject. It is in the light of these unraveled issues about training, that it has a negative impact on teachers' ability to teach the subject. It is, therefore, noted that ineffective teaching adds to the impediments that derail the implementation of Technology Education in schools. Teachers in Nkangala Sub-District are challenged by a lack of training in Technology Education. The researcher maintains that owing to the identified gap, exploring the teachers' views about these impediments is an important step toward improving the quality of teaching and learning.

Engelbrecht *et al.,* (2007:586) attest from the observations in their study with regard to the competency of Technology teachers, that they have not been given sufficient CPTD through

the cascade effort of the DoE to help them cope with Technology Education. According to UNESCO (2002 in Mapotse, 2018:686), within the teacher training programmes, the strategies and plans to enhance the teaching-learning process also need to be developed to ensure that all future teachers are well prepared to use the new tools for learning.

The policy framework states that CPTD should focus mainly on subject knowledge to meet the challenges experienced by Technology teachers, not to forget the PK and skills in a variety of social contexts (Engelbrecht *et al.,* 2007:586). As a result of this policy, the subject CK and pedagogical skills, together with a thorough understanding of the skills required to manage learning in diverse classrooms should be emphasised as the requirements in all the programmes developed (DoE: 2005). Mkandawire (2010:12) argues that "If various education policies and programmes are to be effectively implemented, teachers ought to be adequately trained and motivated. After pre-service training which provides a foundation for professional service, teachers need to keep abreast of new developments in the system through in-service training". Technology teachers who are trained to teach different subjects will require a deep understanding of the subject matter of Technology and need to know which topics to address and how to address them in their Technology lessons (Rohaan, Taconis & Jochems, 2010:16). Gumbo *et al*., (2012:23), concur with the fact that the CPTD is important for teachers who work in an environment of school curriculum change.

3.3 TECHNOLOGY TEACHERS UNDERDEVELOPED PEDAGOGICAL CONTENT KNOWLEDGE

3.3.1 Lack of training and under-qualification

According to DBE (2011:8), teachers in South African schools are qualified to teach a variety of subjects, while teachers of Technology are uncomfortable with the pedagogy thereof (DoE, 2004). Heymanns (2007:37) asserts that a low percentage of teachers feel that the implementation of Technology Education was successful and that schools were ready for the implementation, and a high percentage of teachers feel that Technology Education does have a place in the Further Education and Training (FET) band. On the other hand, Mapotse (2015:214) asserts that Technology teachers are still uncomfortable with its pedagogy and have no qualification to teach the subject, which is still an impediment to most of them. Engelbrecht, Ankiewicz and De Swardt (2007:851) posit that Grades 7 – 9 teachers struggle to teach the subject and they are also not conversant with some Technology concepts.

Studies confirm that Technology teachers are still struggling to adjust to both content and pedagogy of the subject (Mapotse, 2018:686). In this regard, Technology teachers are still faced with many impediments to their teaching. As a result, Technology teachers seem to be ill-equipped to function within the new curriculum system. Without a pedagogical understanding of what exactly transpires in the classroom, this problem will derail Technology teachers' progress in teaching the subject.

Technology is a whole new subject with unique content that is unfamiliar to the majority of the teachers. It is supposed to cover as many themes of Technology as possible, such as Structures, Systems, and Control, Materials, Processing, and Communication. Learners will be expected to excel in a classroom only if teachers understand the Technology concepts and are familiar with the content that needs to be taught to learners. Effective teaching in Technology Education requires teachers to have a deep understanding of the subject matter and a thorough understanding of activities to assist learners to understand the subject matter (Bransford, Brown & Cocking, 2004:188).

It is a lengthy process for underqualified teachers to acquire a lot of skills and new knowledge needed to become professional teachers who are experts in their fields, hence, they are not born with PCK (William, 2012:34). To become effective teachers in Technology Education, the underqualified teachers are required to learn what the career of teaching is about and then practice their teaching skills during student teaching (Busby & Mupinga, 2007:79). Fernandez (2014:80) posits that underqualified teachers require knowledge from different sources, namely personal knowledge, knowledge from initial and continuous training, knowledge of curriculum, and knowledge of professional practice to become professional teachers. Shulman (1987:8) points out that for underqualified teachers to develop skills and knowledge to become professional teachers, they need to go through a process of understanding a cycle of activities of comprehension, transformation, instruction, assessment, and reflection. Darling-Hammond (2004) affirms that for the underqualified teachers to come into the educational setting, they need to be armed with various strategies that they are going to use in the classroom to effectively teach the lesson. De Miranda (2008) asserts that to qualify to be a professional teacher, the underqualified teachers need to know how to take advantage of different approaches that include being flexible and adjusting instructions to account for various learning styles, abilities, and interests. Teachers who have not acquired the skills and

knowledge to teach Technology could result in their teaching not being successful, which is an impediment to the development of PCK in the area of Technology Education.

There are three common factors identified by Kind (2009:170) that appear to contribute to the growth of PCK in early career teachers such as:

- the possession of good subject matter knowledge,
- classroom experience with studies pointing to significant changes occurring in the early month of the year of working as a teacher, and
- the possession of emotional attributes such as professional self-confidence and the provision of supportive working atmospheres in which collaboration is encouraged.

It is important for Technology teachers to attend developmental courses that can help them to conceptualise their professional learning and begin laying a foundation for their own PCK development (Williams, 2012:35). According to the researcher, many teachers enter Technology Education courses being unaware of the impediments they are going to face personally. However, their training could also help to contribute to the effective development of their PCK and learners' understanding of the subject ultimately.

3.3.2 Insufficient pedagogical content knowledge

According to Gumbo (2014:479), the term PCK concerns the idea that the knowledge held by expert teachers represents a unique integration of their pedagogical techniques and their understanding of Technology subject content. Gumbo, Makgato and Muller (2012:23) regard subject matter knowledge and pedagogic skills as the two inseparable factors that are most important to be used to determine whether teachers are fully equipped to teach Technology effectively or not. For effective classroom coaching, Technology teachers need to be able to combine subject matter knowledge and PK of the learning process (Rohaan *et al.*, 2010:17). Fox-Turnbull (2019:1134) affirms that effective teaching in Technology Education involves learners' conceptual understanding of the subject matter and their ability to transfer it to future learning. Park and Oliver (2008:262) regard PCK as an acknowledgment of the importance of the transformation of knowledge per se into subject matter knowledge for teaching. Furthermore, it is important for Technology teachers to develop a deep understanding of CK and PK (Fox-Turnbull, 2019:1134). Therefore, a lack of understanding of the two important

factors, i.e., subject matter knowledge and PK is an impediment to Technology teachers that could contribute to the ineffective teaching of the subject. In that instance, the researcher maintains that Technology teachers are a key to good education and poor education.

For effective teaching of Technology in the classroom to take place, teachers should have a deep understanding of the subject matter. It is imperative for Technology teachers to understand the content to be taught and to administer practical activities effectively with learners to enhance learning. Lack of understanding of the subject matter is an impediment to Technology teachers, which prohibits the successful implementation of the subject. The researcher maintains that it is of great importance that teachers have sufficient knowledge of Technology to develop learners' technological literacy. The best teachers are those who have developed specialist subject knowledge, real passion, and enthusiasm for the subject they teach (Kind, 2009:169).

Mapotse (2015:214) states that the introduction of Technology as a subject could pose many impediments for teachers to teach effectively in the classroom and may be related to:

- lack of confidence for Technology teachers to function properly within the subject,
- inadequate training of Technology teachers,
- struggle with the common understanding and teaching of Technology,
- lack of understanding of Technology as a new subject and how it should be taught in the respective classes, and
- different views of what Technology entails, which could lead to misunderstanding and misconceptions of what the correct understanding and teaching of Technology are.

All this requires that Technology teachers, as well as learners, undergo a paradigm shift to equip themselves mentally for the challenges that await them. Teachers in Nkangala Sub-District, however, should confront more than just a paradigm shift. The new vision of CPTD is referred to as a shifting paradigm. The shift refers to in-service education and training as the term CPTD reflects the professionalising role intended for the educational upgrading of teachers better (Samson, 2013:49). Experienced Technology teachers within the paradigm shift should replace what they are likely to consider good teaching and learning approaches with unfamiliar strategies. According to Mestry, Hendricks and Bisshof (2009:475), the CPTD is a

performance standard that aims to contribute to the professional development of teachers. Mestry *et al.,* (2009:476) further argue that the most important factor for Technology teachers is to be professionally developed. Hill, Ball and Chilling (2008:373) affirm that the preservice programmes and professional development opportunities often focus on improving teachers' knowledge and skills in understanding learners' technological work of thinking. The teacher development programme that does not provide the quality of teacher performance, is also an impediment to Technology Education teaching. Further education and training programmes such as Advanced Certificate in Education (ACE) are one of the paradigms shifts that provide knowledge and skills for Technology teachers. The DBE (2011:29) states that the ACE programme is aimed at addressing the needs of teachers. Kangai (2014:2) further posits that the postgraduate diploma in education (PGDE) was meant for teachers who wanted to further their studies through open and distance learning which offers the best alternative in teacher development and has more advantages and benefits to Technology teachers. These programmes as well as regularly attending workshops for content enrichment are paradigm shifts recommended for teachers in effective teaching of Technology and to eradicate the impediments faced by teachers. "Other professional staff such as laboratory technicians and librarians also need to be in-serviced in order to give sound support to the teaching staff in the implementation of the curriculum". A teacher who does not excel in class will be unable to reach the Technology outcomes. Lack of knowledge, skills and attitudes lead to an impediment for teachers to facilitate Technology effectively in the classroom. Engelbrecht *et al.,* (2007:657) attest those teachers who have a technical background should be orientated into Technology Education and they require a thorough professional teacher development to catch up in becoming competent Technology teachers. Mapotse (2018:686) asserts that teachers need to be encouraged to share, empower and to teach one another within a cluster.

These days, Technology teachers are seen as producers of the knowledge necessary for the practice (Fernandez, 2014:79). This implies that a teacher has a set of skills that are developed during his/her teaching activity (Fernandez, 2014:79). Most people would agree that an understanding of content, matters for teaching (Fernandez, 2014:79). The researcher maintains that teachers who do not possess adequate PCK will experience impediments in the teaching of Technology. A teacher with a depth of PCK understands the selected concepts on how the content will be taught and what he/she will be teaching, appropriate to the study. For teachers who have just completed their qualifications, it is assumed that they possess an understanding of CK and PK which serve as pillars for effective teaching. The development of teachers' PCK

relies on and develops with sound CK and PK (Shulman, 1986:10). The two components can thus be grouped as PCK and will assist the teachers to be effective in a Technology classroom (Hill et al., 2008:373).

The researcher argues that PCK can be the main means of solving the impediments experienced by teachers in teaching the subject. Using PCK means that the teacher should possess enough CK and PK to help learners to learn (Gumbo & Williams, 2014:479). PCK is termed teacher knowledge, a kind of a subject matter - specific professional knowledge which is referred to as a deep understanding of the subject matter (Shulman, 1986:9). PCK also bridges CK and the practice of teaching Technology which was still inadequately understood. The role of PCK is to improve teaching and learning for teacher content preparation. Lack of PCK could lead to an impediment to the majority of Grades 8 – 9 Technology teachers in the Nkangala Sub-District. Mapotse (2018:686) affirms that one of the educational crises in South Africa is that many Technology Education teachers still lack PCK to teach this subject with confidence and with any chance of success. Park and Oliver (2008:268) reveal the five most important features of PCK which complement and add to the current literature. These are:

- PCK development occurred as a result of reflection related to both knowledge-in-action and knowledge-on-action,
- teacher efficacy was evident as an affective affiliate of PCK,
- learners influenced the way that PCK was organized, developed, and validated,
- teachers' understanding of misconceptions was a major factor that shaped PCK in planning, conducting instruction, and assessment, and
- PCK was idiosyncratic in some of its enactments.

The effective teaching of Technology is enabled by the PCK of teachers and a special blend of CK that is built upon over time and through experience (Williams, 2012:34). Teachers' actions are guided by a form of practical knowledge that is used in the classroom setting. Kind (2009:180) argues that PCK is a concept that has come to represent the knowledge that Technology teachers use in the teaching process. In this regard, PCK was shown clearly as a feature of knowledge-in-action. Fernandez (2014:80) states that PCK is a construct that has been widely used in the literature on teachers' knowledge. Regarding all these attributes, Technology teachers who possess a deep understanding of the integration of components of

PCK, experience fewer impediments in the teaching of the subject. In the context of the interpretations of the components, PCK is developed and is regarded as an integrative process in Technology by teachers. Technology teachers should develop PCK to acquire a thorough knowledge of content and pedagogy to be effective in their teaching.

According to Williams, (2012:35), there are also three contributing factors to the growth of PCK. These are as follows:

- Good subject matter: this is important for teachers to have a sound knowledge of the subject matter to disseminate that successfully to the learners. Lack of knowledge may hamper effective learning as a result of a lack of self-efficacy and could affect the performance of the learners drastically.
- Classroom experience: the experience as a teacher also plays an important role in the process of teaching. With relevant classroom experience, the teacher can deal with classroom management effectively and would be able to give practical life experiences emanating from his/her previous class settings. In this case, where teachers are without prior teaching experience on the subject matter knowledge, they may however lack experience in facilitating teaching.
- Possession of emotional attributes such as self-confidence: if teachers possess self-confidence in the subject, he/she is offering, there is a great possibility for that teacher to disseminate the subject matter successfully.

The good subject matter is the whole knowledge and insight that guides Technology teachers' behaviour in the classroom (Rohaan, *et al.,* 2010:272). In the researcher's opinion, the teachers' understanding of the subject matter, has a strong influence on the effective teaching of Technology. The teachers' ability to understand the subject matter, assists them in how learners learn in Technology (Fox-Turnbull, 2019:1134). The teacher's confidence in teaching Technology Education is expected to increase, which subsequently increases their classroom experience.

According to Driel and Berry (2010:658), it is imperative for teachers to develop a sound PCK and to take the following factors into consideration:

- The role of subject matter knowledge: various scholars have posited the teachers' CK is often limited, and this could lead to misconceptions which could subsequently lead to a lack of confidence. Therefore, subject matter knowledge should be imminent for teachers to succeed in their teaching practices. Due to the lack of suitably qualified teachers in the new subjects, teachers are being trained through in-service so that they can teach the subject. This type of training is aimed at providing teachers with insight into what teachers must know and understand, the best way to comprehend, and the best methodologies to teach content to their respective learners.
- Teaching experience: teaching experience is regarded as the prerequisite to teaching a particular content. 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 in teaching the content as allocated.
- A focus on learners' learning: when preparing an instructional strategy, it is important to understand different ways in which learners learn specific content, and in this context, prior knowledge of learners by instruction should be considered.

In light of the above, it is imperative for Technology teachers to develop CK and PK to improve the quality of teaching and alleviate the impediments within Technology as a subject. Also, for Technology teachers to be effective in their teaching, they need to have a deep understanding of CK, and PK. Research has shown that one of the factors that assist Technology teachers to be effective in their teaching is their rich PCK (Williams, 2012:34). According to Williams (2012:34), the academic construct of PCK is a recognition that teaching is not simply the transmission of concepts and skills from teacher to learners but rather difficult to understand and a problematic activity that requires many and varied on the spot decisions and responses to learners' ongoing learning needs. In other words, Technology Education requires teachers to be competent in teaching the subject and have professional knowledge about the content, to reach the outcomes. Williams, (2012:34) argues that professional teachers are not born with PCK, and it is a long process for inexperienced teachers to gain a lot of skills and new knowledge needed to become professional experts in their fields. Less competency is an impediment to the development of PCK in the area of Technology Education.

However, after 20 years of persuasion of work, the bridge between both knowledge and practice was still inadequately understood (Shulman, 1986:9). Mapotse (2017:2), confirms that

though Technology and Technology Education is as old as democracy and implemented as a new subject in South African schools, many studies are still confirming that the majority of teachers are still struggling with both content and deep understanding of the subject. Makgato (2014:3688) writes that since the introduction of Technology Education in 1998, most teachers are still battling with its implementation, particularly in rural schools.

3.4 UNDERSTANDING OF TECHNOLOGY AND TECHNOLOGY EDUCATION AS A SUBJECT

Technology teachers' PCK ultimately has huge implications for their subject knowledge. The discussion under this section addresses this fact.

3.4.1 Technology as a concept

According to Fox-Turnbull (2016:22), the term Technology Education is concerned with the technological processes of investigating, designing, making, and appraising technological solutions for identified problems. Technology is the modification of the natural world to meet human needs and wants (ITEA, 2000:7). In CAPS, Technology is defined as "the use of knowledge, skills, values, and resources to meet people's needs and wants by developing practical solutions to problems, taking social and environmental factors into consideration" (DBE, 2011:8). Department of Education – Technology (2005: 1996) further emphasises the concept of Technology as defined in South Africa from the DoE's perspective as follows:

- the use of knowledge, skills, and resources to meet human needs and wants, and to recognise and solve problems by investigating, designing, developing, and evaluating products, processes and systems.
- the use of knowledge, skills, and resources to meet people's needs and wants by developing practical solutions to problems, considering social and environmental factors (DBE, 2011:6).

The term "Technology" is used to describe different objects, phenomena, processes, knowledge and skills (Nostrom, 2014:2). Teachers need to be well developed with the knowledge of Technology as a concept to ensure effective teaching in the classroom.

The term design consists of two pieces of knowledge, i.e., conceptual knowledge (theory) which encompasses knowledge needed to solve problems, and procedural knowledge (practical) which relates to the processing of the material. Technology Education may be characterised as more of an activity than a discrete body of content (Heymans, 2007:37). It is the actual teaching of Technology whereby learners are given the opportunity to design, make and evaluate a product in response to a need or want. Furthermore, it contributes to learners' technological literacy by giving them the opportunity to learn and understand technological knowledge (Heymans, 2007:37). Technological knowledge consists of conceptual knowledge and procedural knowledge that cannot be separated when practicing Technology. Conceptual knowledge relates to the body of content and procedural knowledge which essentially encompasses the activity (Williams, 2000:48). Conceptual knowledge further refers to the relationship among items, while procedural knowledge consists of two dimensions, i.e., thinking and activity, e.g. hands-on activities. Conceptual knowledge is considered as "knowing what" and it is not in any way a static stage (Leppavirta, Kettunen & Sihvola, 2011:63). According to Pirttimaa, Husu and Metsarinne (2017:218), the concept of procedural knowledge is concerned with the "knowing how" and emphasises the gradual unfolding of ongoing processes. Nostrom (2014:8) states that "knowing how" is about knowing how to do something and is justified mainly through experience, and "knowing that" may be justified by literature. Procedural knowledge is therefore used in Technology Education when learners solve problems individually and share their working knowledge to solve a problem while conceptual understanding is required to enable the development of procedural knowledge. Procedural knowledge is concerned with acting and includes learners' goal-directed actions related to the craft, design, and technology processes and their learning content (Pirttimaa *et al.,* 2017:215). This means that learners should first learn the theoretical aspects and henceforth, they should be able to apply what they have learned effectively. Williams (2000:48) attests that these two components are imperative to assist teaching to be effective in the classroom settings.

According to the researcher, it is imperative for teachers to understand Technology concepts effectively before they can apply them in practice in a classroom. However, it is advantageous to use this concept as it can involve hands-on experience to solve problems in Technology (Pirttimaa *et al.,* 2017:218). If learners learn by doing even if they do not focus on practical activities, they will gain insight and knowledge about the function of Technology. Furthermore, Pirttimaa *et al.,* (2017:215) concur that procedural knowledge includes learners' goal-directed

actions related to Technology processes and their learning content and is mainly produced when acting on something such as hands-on activities. These knowledge practices involve teachers and learners working together towards an achievement. In applying Technology Education, it is important to understand wherever there are consistencies in teaching Technology and the events that are happening in the classroom. According to Engelbrecht *et al*., (2007:580), Technology Education requires a teacher to be well versed in the curriculum content as well as the appropriate teaching of the subject. Engelbrecht *et al.,* (2007:580) argue that most teachers were expected to implement and teach Technology Education in schools without being adequately trained in the content. As a result of the fast-tracked training, most teachers were ill-equipped to operate within Technology settings and a lack of conceptual and procedural knowledge remains a concern. This could result in a situation where teachers have to teach certain concepts without the necessary knowledge and/or self-confidence about teaching topics. In addition to that, teachers who were introduced to teaching Technology in schools were unprepared to function within the new curriculum (Engelbrecht *et al.,* 2007:580).

3.4.2 Understanding of technology and its function

The word "technology" is used to describe a variety of objects, phenomena, processes, skills, and knowledge (Nostrom, 2014:1). According to Mapotse (2012:16), the term Technology Education involves understanding the use of Technology and its impact on the individual and society. Nostrom (2014:2) explains that Technology has existed since the creation of mankind when levers, fire and fermentation were used to achieve particular outcomes. Levers, fire, and fermentation were used technically, which is to produce particular results, long before there was anything reminiscent of scientific theories to explain the underlying mechanisms (Nostrom, 2014:2). Technology is directed towards action and depends on the intentions of the agent who uses or creates it (Nostrom, 2014:4). Based on the examples of how the word "technology" has been used, Mitcham, (1994 in Nostrom, 2014:4) came up with a fourfold description i.e., technology as *object, knowledge, activity,* and *volition.*

The following statements are the fourfold descriptions of technology:

- technology as an *objec*t includes the artifacts that are used in technological activities as well as those that are the results,
- technology as *knowledge* is made up of the knowledge and skills used for example to create, operate, describe, maintain, adjust, and explain technological objects,

- technology as an *activity* is the performance of the activities made possible by the knowledge, and
- technology as *volition* is probably furthest from the everyday use of the term.

Parttimaa *et al.*, (2015:216) concur with the above four modes of the manifestations of technology that are applied in Technology Education. In terms of technological knowledge, two of these modes are closely related to the current study, namely technology as knowledge and technology as an activity. Strimel and Grubbs (2016:24) attest that Technology Education is committed to preparing learners for work and education opportunities by teaching them to understand, design, produce, use and manage the human-made world to contribute and function in a technological society. Morrison-Love (2017:23) concurs that Technology Education in the 21st century offers learners a genuine and valuable range of skills, knowledge, capabilities, contexts and ways of thinking.

The accelerated developments in technology changed peoples' lives to live in a complex and diverse society and the knowledge, skills, and resources used today seem to be different. Technology involves everything around us and the way that people use available resources, knowledge, and skills, through different processes, to develop the world and satisfy people's needs and wants (Heymans, 2007:40). Also, learners should understand and be able to develop the knowledge and skills of using different tools, materials, and machines in real-life situations. Blomdahl and Rogala (2008:19) indicate that for learners to be technologically literate, they need to acquire concrete content and solve real-life situations, as well as be introduced to Technology as a new subject in schools.

According to Asunda (2012:47), technology can develop new knowledge and skills to change the world and put together pieces of materials to satisfy needs and wants. Being technologically literate enables teachers to use, manage, assess and understand technology. Technological literacy relates to one's ability to manage, utilise, evaluate and understand the technology and how it works (Dugger, 2008:3). To be more technologically literate, it is imperative for a teacher to fully understand what technology is, how it works and how it shapes society. A teacher who is not technologically literate cannot teach Technology with confidence, which is an impediment to reaching the outcomes. A technologically literate teacher should be comfortable with the objectives of teaching Technology. Once the teacher is comfortable with

the teaching of Technology, this suggests that he/she will experience fewer impediments in the subject.

3.4.3 Technology/Technology Education

According to Gumbo (2018:129), the definition of Technology and Technology Education rest mainly on design in the context of solving technological problems and meeting human needs and wants. Technology and Technology Education are two concepts that motivate learners to develop their skills and construct their solutions to meet human needs and wants (Nokwali *et al.,* 2015:564). Technology Education never existed as a formal subject in South African schools until such time that C2005 was introduced. The National Education Policy Act deemed it necessary to introduce Technology Education as a formal subject to be implemented in South African schools (National Education Policy Act No 27 of 1996). DoE (2007) defines Technology Education as "…a study of technology which provides an opportunity for learners to learn about the processes and knowledge related technology that is needed to solve problems and extend human capabilities". Mapotse (2018:686) posits that Technology Education is now a stand-alone subject that develops technological problem-solving skills through hands-on project designs and is offered within the school curriculum of many countries. The researcher argues that Technology teachers, without an understanding of technological processes, are unable to create a conducive learning environment in the classroom. Also, teachers who are not technologically literate are likely to teach certain concepts without the necessary assurance and confidence in the teaching of the subject. It is important for Grades 8 – 9 Technology teachers in Nkangala Sub-District to work collaboratively to achieve success in Technology teaching. Kowin and Jones (1990:2) state that Technology Education assists learners in becoming technologically literate by focusing on hands-on activities by developing problem-solving adaptation skills and a positive attitude toward Technology.

Furthermore, Technology Education refers to a need to promote the capability of learners to use, evaluate and design appropriate technological solutions to problems (Ankiewicz, De Swart & Gross, 2001:189). According to the researcher's knowledge, Technology Education in the curriculum is a subject that is foreign to the majority of Technology teachers. However, Technology Education appears as an important part of the general education of all teachers and learners globally. Mapotse (2014:214) attests those skilled teachers are needed to teach the subject of Technology due to its nature, particularly as a theory-practice-based subject.

According to Love (2017:23), learners in the 21st century are most fortunate as Technology Education offers them an opportunity to a range of skills, knowledge, capabilities, contexts and ways of thinking specifically in the ability to develop and use new technologies. Those skills are accepted as being important in today's workforce and society. Snape and Fox-Turnbull (2013:52) emphasise that for lifelong learning, learners need to understand, appreciate and engage with the world in which they live to meet the requirements of sustained learning and effective participation in society.

Teachers play a greater role in the learners' learning than any other factor associated with learning. On that note, teaching should therefore begin with a clear understanding of what is to be learned and taught. Learners learn best when Technology Education teachers spend most of their time focusing on content and when the learning activities are directed to the learners' level of comprehension. Liu and Szabo (2009:6) attest that for learners to learn from a passive transfer of information to active learning, the teacher would create situations that learners can experience, instead of delivering the plain information. In addition to that, it is important for Technology teachers to arrange information in a manner in which learners can understand it better. Teachers have more impact on learners' learning than any other factor associated with learning and how successful the use of Technology will be in education. For instance, factors like class size and the quality of after-school interventions such as remedial classes for learners progressing slower than other learners, however will only be possible when Technology teachers have thorough content knowledge. Liu and Szabo (2009:7), concur that to bridge CK and knowledge about the practice of teaching, teachers should possess subject-specific professional knowledge. If the teacher does not possess enough content knowledge, he/she will experience the impediments to teaching Technology effectively. According to Gumbo (2016; 2018) and DBE (2011), the specific aims of Technology Education are stated thus: Technology as a subject contributes towards learners' technological literacy by giving them opportunities to:

- develop and apply specific design skills to solve technological problems,
- understand the concepts and knowledge used in Technology Education and uses them responsibly and purposefully, and
- Appreciate the interaction between people's values and attitudes, technology, society, and the environment.

In the context of the above opportunities, studies confirm that Technology teachers will still struggle with both CK and pedagogy of the subject unless radical interventions are implemented to transform the situation (Mapotse, 2018:686). As a result of the change, Technology Education has experienced a disorder that was expected from the teachers concerning what and how to teach, as well as to "translate the new curriculum into implementable classroom activities" (Lee, 2011:43). The changes include the overhauling of curricula followed by strategic and symbolic review, which was also a sign of change since the first democratic election in 1994 (Mapotse, 2018:686). Makgato (2014:3688) posits that changes in the South African school system created an urgent need for the training of teachers. The Technology Education content consists of these broad themes: mechanics, materials, electronics, automatic control, technological systems, the product development process, and technology's relation to the sciences, to society at large, and the fine arts (Nostrom, 2014; Gumbo, 2016). Technology Education is a subject that needs special training for teachers due to its nature, particularly as a theory-practice subject (Mapotse, 2014:214). The poor training of Technology teachers leads to an impediment for teachers to implement the subject effectively in the classroom.

Technology is adopted by teachers in different ways and is based on feelings and impulses that are influenced by the content of the curriculum as well as the current teaching (Duffee & Aikenhage, 1992:493). The teachers' role and their ability to meet the changing and complex needs of modern teaching and learning are important for engaging learners in a meaningful context. Snape and Fox-Turnbull (2013:52) state that the effective teaching of Technology requires teachers to engage learners in interacting, solving problems, applying skills and making decisions about meaningful issues to understand their world.

3.5 TEACHERS' LACK OF SELF-EFFICACY WHICH ADDS TO THE IMPEDIMENTS

Teachers cannot speak openly about the implementation of Technology while they still show a negative attitude towards the implementation process due to feeling of uncertainty. This might be because they are still not confident about the subject and not comfortable about what is expected from them. Hartell, Doyle and Gumaelius (2019:195) attest that Technology teachers do not have the content expertise or confidence in teaching new Technology concepts as they

are assigned by curricula. Teachers who lack the necessary insight regarding the different content areas within Technology, for instance, processing, structures, systems and controls will develop a negative attitude towards the subject. It is in this light that the researcher opines that Technology teachers should first develop knowledge and self-efficacy and the ability to teach the subject before being introduced to Technology concepts. The teachers' role and abilities are important in engaging learners in meaningful contexts to meet the changing and complex needs of modern teaching (Snape & Fox-Turnbull, 2013:52). According to Mapotse (2012:6), teachers can implement Technology with confidence and comfort on their own only if guidance can be provided. Teachers not educated in Technology Education generally express a negative attitude toward perceived control (Nordlof, Hallstrom & Host, 2019:123). Perceived control concerns the teacher's perception of having control over both external and internal factors influencing teaching.

However, perceived control is a component that includes self-efficacy and context-dependency influencing teaching. According to Nordlof *et al.*, (2019:125), self-efficacy consists of internal factors such as collegial support, teaching time and materials, as well as a feeling of personal capabilities. Self-efficacy is a person's own belief in their efficacy and could be described as a judgment of one's own personal ability to teach (Van Aalderen-Smeets, Walma, Van der Molen & Asma 2012:159). Rohaan, *et al.*, (2012:271) add that self-efficacy has a strong influence on teachers' attitudes towards Technology. According to Nordlof *et al*., (2019:126), self-efficacy can be assumed as part of the teachers' attitude toward Technology teaching, and it is seen as a second element of the component of perceived control. However, teachers who have not acquired knowledge and self-efficacy to teach Technology will develop a negative attitude toward teaching the subject. In addition, the negative attitude of teachers toward Technology teaching is an impediment that hinders the successful implementation of the subject. Therefore, the development of teachers' negative attitudes towards the successful implementation of Technology emanates from lack of support and resources which impedes the teaching in turn. According to Hartell *et al.*, (2019:196), teachers' self-efficacy is of great importance when considering learners' learning opportunities and thus difficult to measure.

The impediments experienced by Technology teachers block their creative and critical thinking, which leads them to develop a negative attitude towards the subject. According to Ozden (2007:157), the teachers' attitudes and the main problems with Technology Education emanate from the following:

- insufficient number of Technology teachers' taking an active role in the preparation of the programmes,
- insufficient in-service training of the science teacher in the transition state of a new programme,
- the huge numbers of the learners in the class,
- lack of adequate support of teachers,
- discipline problems of learners, and
- Lack of appropriate and sufficient resources and learning materials.

Schools in the Nkangala Sub-District lack Technology teachers who are qualified to teach the subject, and this could lead them to be ineffective to operate within the curriculum. Most of the teachers are being redeployed to other schools hence teachers of other subjects are forced to teach Technology without proper knowledge of the subject under the circumstances. Teachers are falling behind due to insufficient training and development programmes by the DBE Mpumalanga (DBEM). The CI's did not receive adequate training to train Technology teachers to be effective in their classrooms (Makgato, 2014:3689). Radical changes are being made through policies that in turn are not supported by an appropriate structure for teacher training and development (Gumbo, 2018:129).

Although teachers' attitude has been assessed before curriculum development, teachers who have a negative attitude in a Technology Education programme will also develop a negative attitude towards the teaching of the subject (Boser, Palmer & Daugherty, 1998:6). The changes in the education system, however good, always bring with them doubts, distrust, and possible negative attitudes (Nokwali *et al.*, 2015:564). A Technology teacher is expected to be effective in the classroom only is he/she has adapted the knowledge and skills needed to teach Technology from the programme. However, teachers who are incompetent and not adapted the knowledge and skills to teach Technology will develop a negative attitude towards the subject. Therefore, teachers will develop a negative attitude towards the teaching of Technology due to lack of subject matter knowledge and insufficient pedagogic skills, which is an impediment for teaching of the subject (Gumbo *et al.,* 2012:23). In many schools, Technology teachers have to cope with large class sizes, which complicates the learner-centred approach and available teachers are thus overloaded in terms of teacher-learner ratio, which makes the effective

facilitation of Technology difficult (Mapotse, 2017:10). This could lead to class management problems and weaker learners not getting sufficient attention in terms of remedial work and academic backlogs. However, the implications of class size might be caused by inadequate infrastructure such as classrooms. In some schools, overcrowding takes place, and spaces that are unsuitable for learning purposes have to be utilised. Therefore, effective learning could not take place in an unsuitable learning environment. This situation could add to teachers' attitudes towards the subject.

In the context of the above, the negative attitude of teachers towards the subject is an impediment in the teaching of Technology. Therefore, teachers need to understand the Technology concepts to develop a positive attitude in the teaching of Technology. The negative attitude of teachers could create an environment that is not conducive to learners in a Technology classroom. The negative attitude could further result in a situation where teachers have to teach certain concepts without the necessary knowledge. Lack of adequate support structures from subject advisors and management support services could lead Technology teachers to develop a negative attitude towards the subject (Gumbo, 2018:129). This could result in a situation where teachers could not develop self-confidence about teaching the topics. Teachers' lack of confidence and incapability to teach Technology are aspects that create a negative attitude toward teaching the subject Rohaan *et al.,* (2010:15). This could further complicate the implementation of the new curriculum and cause attitudes of mistrust toward Technology Education from teachers.

Technology teachers often experience problems of learners who are not committed to their schoolwork and adhere to the code of conduct as well as their frequent absenteeism which could add to the negative attitude of teachers towards the subject. A lack of support of learners from parents displays a liassez-faire attitude toward their school commitment. These could however lead to Technology teachers developing an attitude towards the ineffective implementation of the subject. The other major problem that can cause Technology teachers to develop a negative attitude towards the teaching of the subject is the lack of appropriate and sufficient resources and learning materials. Lack of fundamental resources such as laboratories, libraries, and inadequate school furniture are also viewed as constraints that are not conducive to the successful implementation of Technology (Makgato, 2014:3688). However, all these factors could lead teachers to develop a negative attitude toward the effective implementation of Technology. The researcher affirms that these negative factors also lead to impediments that

teachers experience in the Nkangala Sub-District, and these must be resolved if Technology teachers are to develop a positive attitude towards the subject.

3.6 PEDAGOGY OF TECHNOLOGY EDUCATION

Technology is a broad area that focuses on many core concepts such as structures, systems and control and processing. Therefore, to present these to learners, it requires teachers to know and apply diverse technological methods (Mapotse, 2012:50) as an element of Technology teachers' PCK. Teaching methods assist teachers in approaching Technology meaningfully and to teach effectively in a classroom. According to the DoE (2011:8), for Technology teachers to be effective in their teaching practices, it is imperative that they are well versed with subject knowledge and understanding of different teaching methods. Felder and Prince (2006:123) posit that there is a range of instructional methods to teach Technology Education that includes inquiry learning, problem-based learning, project-based learning, case-based teaching, discovery learning, and just-in-time teaching.

All the above methods are constructivist, meaning that learners construct their own version of reality than simply sucking information presented by their teachers (Prince & Felder, 2006:123). The methods also fall under inductive teaching which means they are learner-centred which imposes more responsibility on learners for their own learning. Furthermore, they are regarded as active learning which involves learners discussing questions and solving problems in the classroom (Prince & Felder 2006:123). The use of teaching methods enables teachers to work with ease and to be effective in a Technology classroom. Makgato (2014:3689) affirms that teachers should develop a pedagogical understanding of how teaching and learning take place in Technology before the actual teaching.

Brown, Ernst, Clark, DeLuca and Kelly (2017:30) attest that Technology teachers use different delivery methods to assist learners in achieving success in mastering the concept. The experts in the Technology curriculum recommend the use of different teaching approaches such as self-paced modules, interdisciplinary methodology, and problem-solving to inform learners about Technology and its effects on society (Boser *et al.,* 1998:4). Self-paced module teaching is recommended as an appropriate method that best accommodates diversity in the classroom. Interdisciplinary teaching is used by teachers to integrate Technology with other subjects. Therefore, it is important for learners to understand the interrelatedness of other subjects with

Technology. According to the researcher, using different approaches to teaching Technology is imperative in assisting teachers to be effective in their teaching. Technology teachers who have the knowledge, skills and capability to teach Technology can promote learners' technological literacy (Boser *et al.,* 1998:4). Furthermore, well-trained Technology teachers understand how to vary instructional delivery methods that allow them to help motivate learners, connect learners' prior and subsequent learning, incorporate high order thinking and problem-solving skills into activities and lessons, and quickly assess learners learning before, during, and after the lesson. According to the researcher, a teacher who possesses a PCK understands how to engage learners in the effective teaching practices of Technology Education to achieve successful outcomes. Technology teachers with a lack of CK are unable to employ different delivery methods to enable them to assist learners in becoming familiar with the concepts. Furthermore, to assist the learners to anticipate what will be expected at the end of the lesson which is an impediment to the majority of the teachers.

Understanding different teaching methods involve teachers' interaction with the learners and improving learners' technological literacy (Fox-Turnbull, 2019:1134). The researcher affirms that different delivery methods could be useful in assisting teachers' ability to develop ideas and strategies for how learners should learn in Technology. Technology teachers are used to a talk-and-chalk method, while learners solve simple textbook problems of the subject (Garfield de Waal, 2004:57). In observations conducted by Norstrom (2014:13), there were no tests for national assessment, and textbooks were not regularly used in the Technology subject. Furthermore, in many schools, there are no laboratories and equipment where learners can perform practical work or hands-on activities, and this can also be related to one of the impediments faced by Grades 8 – 9 Technology teachers in Nkangala Sub-District that hinder effective teaching. Technology teachers should facilitate the design process so that learners can practice procedural knowledge effectively.

The design process is the basic method that Technology teachers should master. Gumbo (2018:131) therefore posits that in CAPS, the design process is the backbone of Technology and thus includes investigation, design making, evaluation, and communication. The design process is a model that consists of different activities or stages one has to go through in order to come out with solutions to achieve the aims of Technology (Appiah, 2014). According to DBE (2011:9), the design process allows learners to:

- “Develop and apply specific design skills to solve technological problems.
- understand the concepts and knowledge used in Technology education and use them responsibly and purposefully.
- appreciate the interaction between peoples’ values and attitudes, technology, society and the environment”.

Therefore, from the point mentioned above, it stands to reason that in Technology Education the term “design process” and “problem-solving” are construed to be synonymous. However, lack of understanding and the use of the design process are impediments for teachers to facilitate Technology properly in the classroom.

Cabrera and La Nasa (2008:13) define effective teaching as “one that produces demonstrable results in terms of the cognitive and affective development of the learners”. According to Cabrera and La Nasa (2002:13), the examples for implementing effective teaching practices in Technology are provided below:

- Utilisation of a variety of teaching delivery methods, not just lectures. Teachers, who tell learners all of the information that they should know are limiting learners' ability to predict, analyse, synthesise and evaluate ideas and concepts.
- Connections between prior and subsequent learning by asking learners or administering a pre-test to determine what they "know" and trying it into what they will learn, through discussion.
- Promotion of higher-order thinking and problem-solving skills.
- Assessment of learners’ learning before, during, and after the lesson benefits learners and teachers alike. Assessment can be quick and simple or comprehensive, depending on the situation.
- Enhancement of learners' transferability skills and create sustainable learning by ensuring that they are actively engaged in their learning process.
- Teachers’ continuous capturing of the curriculum in a variety of ways to meet the needs of all the learners.

In the context of the above statement, the researcher claims that Technology teachers should work together for learners to develop the skills and experiences necessary to relate to real-

world situations. When teachers work together to overcome a problem, they should do so, more than just talk (Fox-Turnbull, 2016:24). The role of Technology teachers in Grades 8 – 9 and how they engage themselves to meet the changing and complex needs of modern teaching and learning are also important to engage learners in a meaningful context of teaching. It is likely for Technology teachers who engage themselves in using this best practice effectively to experience fewer impediments in the teaching of the subject. Technology teachers who engage themselves in best practices should be able to apply the knowledge and skills best suited for learners in the classroom, for effective teaching and to enable them to understand and use what has been taught. Effective teachers are identified as being critical facilitators of an effective Technology learning environment, whereby they are willing to provide continuous feedback to learners (Best & MacGregor, 2017:202).

Many disadvantaged schools are faced with challenges of lack of resources as well as unqualified educators. The implementation of Technology Education in schools is sometimes a great challenge for teachers. The challenges are characterised by the following aspects as identified by Moalosi and Molwane (2008:33): (i) lack of resources and teaching material, (ii) detailed syllabus, which compels teachers to give summaries of the subject matter, and (iii) some modules are difficult to understand. These challenges reduce the opportunities available for teachers to take part in education and training (Chigona, Chigona, Kayango & Kausa, 2010:21). All these challenges result in an impediment to Technology teachers which denies them the opportunity to teach with confidence. In order to ensure the success of Technology Education, the choice of teaching and learning materials plays a significant role. It is therefore important to have a thorough understanding of the use of such materials to ensure that they are applied effectively in a Technology classroom.

In the context of the above statement, Korwin and Jones (1990:2) state that recently, the main focus of Technology Education is on the use of tools and materials to help learners in understanding concepts and their relationships to various areas of education. According to the researcher, the effectiveness of Technology in a classroom is whereby teachers use hands-on activities to relate the concepts. In addition to that, Technology Education is one of the subjects for engaging learners' interest by involving practical work in their studies. Gumbo (2018:130) explains that for effective teaching to take place in the classroom, Technology teachers should be able to engage learners in design processes and knowledge to solve problems. It was for this reason that ineffective teaching of Technology might develop from impediments experienced

by teachers who are unable to engage learners in the knowledge and skills to solve problems and to acquire technological processes. However, a hands-on activity approach might serve as an appropriate and effective basis for learning in Technology Education. Strimel and Grubs (2016:24) affirm that through hands-on experience, learners should show an understanding of all domains relating to Technology using a systematic, problem-solving approach. Strimel and Grubbs (2016:24) further attest those hands-on activities assist the learners to be technologically literate by developing problem-solving adaptation skills and a positive attitude towards Technology. It is imperative for schools to have laboratories for Grades 8 – 9 teachers to perform practical work by doing hands-on activities. Teachers who are capable of teaching Technology effectively could produce quality results at the end of their teaching, and the effect of those who are incompetent could produce poor learner results, which is one of the impediments faced by Technology teachers. Korwin and Jones (1990:5) advise that hands-on activities or experiences can lead to greater cognitive gain. If learners are introduced to hands-on activities, it is easy for them to focus on what they are doing, and a long-term goal will be developed such as gaining insight and knowledge about the function of Technology.

3.7 CONCLUSION

In this chapter, a discussion was presented with regard to the literature pertaining to Technology and its related concepts. Under the discussion on Technology as a subject, a further discussion about technology literacy which relates to one's ability to use, manage and understand in full was also emphasised. Once there is a full understanding of what Technology is all about, teachers would be comfortable and confident in using technology effectively. However, this applies to Technology Education which has become a compulsory subject in the South African school curriculum and guides learners to solve real-life problems. Furthermore, it was noticed that there are challenges in the teaching of Technology characterised by the lack of teaching material and resources, as well as a detailed syllabus, which forces teachers to teach the subject matter briefly instead of giving details. The impediments which hinder the successful implementation of Technology Education were also highlighted. Another important aspect covered in this chapter is the effectiveness of PCK used by Technology teachers to teach the subject as well as their attitude toward its implementation.

In the chapter to follow, a detailed discussion of the research methodology is outlined. This includes the research design and methods followed during the data collection.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

A brief discussion of the previous chapters is highlighted first. Chapter 1 presented the orientation into the study about the impediments that teachers face in the implementation of the curriculum. In that chapter, the existing gap in the literature was identified and the research problem, questions, and objectives were stated among other things. Chapter 2 discussed PCK which was chosen as a framework for the study. Furthermore, the chapter explored the evolvement of PCK, its main elements, and how it can be related to teacher knowledge. Chapter 3 of the literature review focused on the impediments faced by Technology teachers in the teaching of the subject. Key issues discussed include, among others, Technology teachers' shallow understanding of the curriculum, their underdeveloped PCK, lack of understanding of Technology and Technology Education as a subject, and lack of self-efficacy in the subject.

In the current chapter, the research design and methods employed in this study are discussed and substantiated. The study articulates how the research process was followed at the selected site to investigate the teachers' impediments in the sampled schools. As such, the chapter accounts for design, population, and sampling, data collection process and procedures, data analysis, and a mechanism followed to ensure trustworthiness and ethical considerations.

4.2 RESEARCH SITE

The schools are of different types which are primary, middle and secondary schools. All the schools are located in the rural areas and in Nkangala Sub-District which forms part of the broader JS Moroka municipality. Most of the learners from these schools are occupants of the nearby informal settlements and surrounding villages. The majority of the schools are to a certain degree in bad condition, both infra-structurally and financially. Most of the teachers are teaching the subject without terminal qualifications related to Technology. Terminal qualifications are when students graduate from their chosen academic program with a terminal degree, which means that they have reached the highest level of education available in their chosen field (Lankford, 2001). They are also challenged by a number of problems. Firstly, there is a lack of learners' commitment to their schoolwork and rules and frequent absenteeism of

both teachers and learners. Secondly, there is a lack of appropriate and sufficient resources and learning materials. The third problem is the inability of the schools to employ sound management and governance structures. Fourthly, schools have to endure continuous vandalism and theft of property. This impacts negatively on the learners' academic progression.

4.3 RESEARCH PARADIGM

In carrying out research, it is important to choose a paradigm or a philosophy that is applicable to the problem under investigation. A paradigm is described by Collis and Hussey (2014:10) as a "framework that guides how research should be conducted, which is based on people's philosophies and assumptions about the world and the nature of the knowledge. The philosophical framework focuses more on how data will be collected, analysed and utilised in the research project". Primary data can be collected in different forms, for instance, experiments, questionnaires, interviews, and focus groups. Secondary data are another type of data, which refers to data that have been collected and exist in various sources such as books, publications, and internal records. Collis and Hussey (2014:12) identify two main research paradigms namely, the positivist approach and interpretivism.

Bertram and Christiansen (2014: 23) indicate that positivistic researchers aim to avoid being biased by not allowing their own values and beliefs to interfere with the research. In this instance, the researcher should remain impartial in presenting the results of the study. The goal of positivistic research is to describe, control and predict how the natural and social world works. The difference is that there are post-positivists who reject the positivists' claim that the world can be known completely (Bertram & Christiansen., 2014:23). A positivist paradigm relates to the belief that social reality is singular and objective and it is not affected by the act of investigating it (Collis & Hussey 2014:43). In the end, the positivistic paradigm stems from applying logical reasoning to the research with more emphasis on objectivity, precision, and rigour. The positivist paradigm is associated with quantitative methods of analysis based on a statistical analysis of quantitative research data (Collis & Hussey, 2014:46).

As this study is qualitative in nature, the interpretive approach was adopted. This approach is more inductive as the researcher directly relates to what is observed and seeks to describe and translate the findings (Collis & Hussey, 2014:85). The findings are derived from the qualitative methods of analysis which are based on the interpretation of the qualitative research data. With

this philosophy, the researchers are required to show how they have analysed the data and reached the conclusions drawn (Bertram & Christiansen, 2014: 27). The conclusion drawn should emerge from the participants who were part of the study. In other words, the researcher should be guided by the analysis and avoid subjectivity when presenting the findings. Interpretivism is concerned with accessing and understanding an individual's perceptions of the world. Basically, reality is seen as a social construct given meaning by people rather than being based on objective or external factors, in other words, the aim is to understand the meanings people ascribe. Robson (2011:80) explains that this philosophy is used when the researcher intends to develop a new theory and is looking at the change processes over time. The interpretative approach generates more meaningful and qualitative data which are derived from peoples' perceptions and beliefs about socially constructed events (Bryman, 2014:122). In this study, interpretivism was used to explore the impediments experienced by teachers when they teach Technology. This approach is more inductive in nature as the researcher directly relates to what is observed, seeks to describe, and translates experiences observed in the field (Collis et al., 2014:85). This approach is more about exploring the complexity of social phenomena with the aim of gaining interpretive understanding.

DoE (2003:31) identifies four ways through which technology can be conceptualized and better understood. Technology as:

- Knowledge (epistemology as a field in philosophy),
- Activity (methodology as a field in philosophy),
- Object (ontology as a field in philosophy), and
- Volition (teleological, ethical and aesthetic, as fields in philosophy).

Crotty (2003:10) define ontology as "the study of being". It is also concerned with "what kind of world we are investigating, with the nature of existence, with the structure of reality as such". The ontological assumptions are those that respond to the question 'what is there that can be known?' or 'what is the nature of reality? (Guba & Lincolin, 1989:83). Technology Education absolutely must have teachers, experts in a subject, who are experts in learning. Technology teachers should also know about the impediments they are faced with in teaching the subject.

According to Crotty (2003:3) epistemology is "a way of understanding and explaining how we know what we know". Maynard (1994:10) states that epistemology is also "concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate". Technology teachers should be trained on how to teach the subject effectively. They should be able to deal with the impediments facing Technology teachers when teaching the subject by using resources. Technology teachers should understand and know exactly how best to teach the subject effectively. Crotty (2003:3) posit that methodology is "the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of the methods to the desired outcomes." For effective teaching of the subject, Technology teachers should know how to teach effectively using different methods and techniques for better outcomes of the subject.

4.4 RESEARCH APPROACHES

The research approaches are either classified as qualitative, quantitative, ormixed-method, which are distinct approaches to research (Bryman, 2006:97).

This study follows a qualitative research approach that is explorative and contextual in nature. Qualitative research is concerned with qualitative phenomena involving quality and characteristics that are examined for a better understanding of the real situation (Heining, Van Rensburg & Smith, 2008:5). A qualitative approach is therefore used in this study in order to gain an understanding of the real situation faced by Technology teachers in the Nkangala Sub-District schools. Bertram and Christiansen (2014:40) define qualitative research as a way of trying to understand a distinct methodological tradition of inquiry that explores a social or human problem. Qualitative research has been chosen for this study and a design framework structured as a step-by-step process of research. The purpose of exploration is to gain richer data and an understanding of the teachers' experiences (Maphorisa, Poggenpoel & Myburgh, 2002:24). The contextual approach is described as one approach in which the phenomenon under investigation is essentially studied in accordance with its intrinsic and immediate contextual significance (Mouton, 1996:168).

In this study, the research methods were used to understand how Grades 8 – 9 Technology teachers in Nkangala Sub-District respond to the impediments that affect their teaching of

Technology. This approach allowed the teachers to unravel their experiences and encounters with a clear intention of providing an understanding of the phenomenon under investigation.

An inductive approach was therefore applied which begins with a set of empirical observations, seeking patterns in those observations and then theorising about those patterns. This approach relies mainly on the use of qualitative data collection methods to gain a better understanding of the factors, for instance, the impediments faced by Technology teachers. Silverman (2004:154) explains that when carrying out qualitative research, the actual process is, in fact, both iterative and inductive and that the researcher will essentially "start with a question or issue, collect data, analyse the data that they have collected, start to formulate a theory, go back and look at or even collect more data if necessary". I was guided by this approach during data collection.

A quantitative research method deals with quantifying and analysing variables in order to get results (Apuke, 2017:41). Mixed method research is defined as a procedure for collecting, analysing and combining both quantitative and qualitative data at some stage of the research process within a single study to understand a research problem completely (Creswell, *et al.*, 2016:313).

4.5 RESEARCH DESIGN

The research design refers to a plan on how the research will be carried out to answer a research question (Terre Blanche, Durrheim & Painter, 2006; Saunders, Lewis & Thornhill, 2012; Bertram & Christiansen, 2014), and this serves as a blueprint for the research journey. Creswell *et al.*, (2016:54) identify three types of research designs in qualitative research which include:

- Exploratory – Exploratory qualitative studies tend to be primarily inductive, working largely with an emerging theoretical framework rather than within an established theory or set of hypotheses deduced from it.
- Descriptive – Descriptive research design aims to describe some group of people or phenomena or other entities. Descriptive research can serve as a variety of research objectives, but descriptive studies tend to be primarily concerned with finding answers to "what" questions, such as: what are teachers' attitudes towards using computers in school?

- Philosophically/theoretically grounded qualitative research – In philosophical/theoretically grounded qualitative research, it is believed that natural, physical laws exist that determine all occurrences, including human behaviour. In other words, there is a fixed reality out there that is determined and regulated by independent physical laws. It is the task of the researcher to discover the laws or universal truths by employing research techniques that will make it possible to uncover them.

Researchers explore when they possess little or no knowledge about a phenomenon, group, process, activity or situation. The objective of exploratory research is to identify key issues and variables to gain greater understanding of a phenomenon, a group of people or a social setting. To explore a given phenomenon effectively, researchers must approach it with two special orientations, i.e., flexibility in looking for data and the most effective approach is to search for the understanding of where it may be found, using an ethical method that would produce the required data. Case-study research can also take the form of an exploratory study where a specific case is analysed and studied in greater detail to explore and gain a better understanding of a particular phenomenon typical of the case.

The universal stance is that the scientific method of experimentation is the only way of finding the truth. The scientific method prescribes a set of assumptions and beliefs about reality and how reality may be objectively discovered. One of the key aspects of the scientific method was to be able to generalise the research findings. The primary aim of the study is to understand the nature of impediments that Grades 8 – 9 teachers of Technology face in the Nkangala Sub-District of Mpumalanga.

Exploration was chosen by the researcher to explore impediments faced by teachers in teaching Technology since they possess little or no knowledge about this phenomenon. The objective of exploratory research is to identify key issues and to gain a greater understanding of impediments that affect Grades 8 – 9 teachers in teaching Technology. Case-study research could also take the form of an exploratory study where a specific case is analysed and studied in great detail to explore and gain a better understanding of a particular phenomenon typical of the case (Creswell et al. (2016:55). Baxter and Jack (2010:549) identify the types of case studies and their definitions as:

- Explanatory – this type of case study would be used if a participant was seeking to respond to a question that sought to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies.
- Exploratory – this type of case study is used to explore those situations in which the intervention being evaluated has no clear, single set of outcomes.
- Descriptive – this type of case study is used to describe an intervention or phenomenon and the real-life context in which it occurred.
- Multiple case studies – it enables the researcher to explore differences within and between cases. The goal is to replicate findings across cases. It is imperative that the cases are chosen carefully so that the researcher can predict similar results based on the theory.
- Intrinsic – this type of case study is not undertaken primarily because the case presents other cases because it illustrates a particular trait or problem, but because in all its particularity and ordinariness, the case itself is of interest.
- Instrumental – it is used to accomplish something other than understanding a particular situation. The case is of secondary interest, it plays a supportive role in facilitating our understanding of something else. The case is often looked at in-depth, its contexts scrutinized, its ordinary activities detailed, and because it helps the researcher pursue the external interest.
- Collective – are cases that are similar in nature and description to multiple case studies.

A case study design was chosen for this study to provide more insight into impediments faced by Technology teachers in the teaching of Technology. Rule and John (2011:4) define a case study as a systematic and in-depth study of one particular case in its context. This type of design is aimed at capturing the reality of the participants' experiences and thoughts about a particular situation (Creswell, 2012), for example, the issues that are associated with the subject of Technology in this study, which are Technology teachers' shallow understanding of curriculum, Technology teachers' underdeveloped PCK, understanding of Technology and Technology Education as a subject, Technology teachers' lack of self-efficacy in the subject. This type of design was chosen because it allowed the researcher to examine a particular case in detail instead of paying attention to multiple instances superficially (Yin, 2003; Rule & John, 2011).

The design enabled the researcher an opportunity to understand the impediments that Technology teachers face in the identified context and would help bring improvements that could boost the morale of Technology teachers in the subject. It could also help direct the improvements that might be necessary for the current professional development training for Technology teachers. The case study in question is exploratory. This means that the researcher enabled the participants to share their experiences in their daily operations. An exploratory case study is therefore used to explore a new field of research when the exact research question is not clear when it comes to impediments faced by Technology teachers. Furthermore, the researcher needed to use the explorative research design in order to seek new insight and generate ideas about impediments faced by teachers in the teaching of Technology. According to Welman, Kruger and Mitchel (2005:193), the term "case study" pertains to the fact that a limited number of cases are studied intensively. In this study, case studies are more exploratory, focusing rather on the generation of theory than on testing (Yin, 2003:13). The initial step for the exploratory case study is to investigate the topic. A detailed view on the topic needs to be presented. The researcher needed to use the exploratory research design in order to seek new insight and generate ideas about Technology Education resources and practices in teachers' natural settings. The purpose of exploration is to gain an in-depth understanding of the experience of the teachers and the strategies they use to offer the subject under investigation.

4.6 Population and Sampling

Population and sampling are discussed in detail in the following sub-sections.

4.6.1 Population

The primary aim of the study is to understand the nature of impediments that Grades 8 – 9 teachers of Technology face in the Nkangala Sub-District of Mpumalanga. According to the subject allocation, Technology Education is only available as a subject from Grades 8 – 9 classes hence the teachers are appropriate as they were able to share their experiences and challenges in relation to the teaching of Technology Education. Other teachers from Grades 10 – 12 are inappropriate to respond to the impediments faced by Technology teachers since Technology Education is not part of the subjects allocated to the higher grades. McMillan and Schumacher (2006:119) define the population as a group of elements, whether individuals that conform to particular criteria as set out for the study and to which the researcher intends to generalise the results of the research.

As the study follows a qualitative approach, it was impracticable to survey the entire population, therefore non-probability sampling was used. Non-probability sampling relates to when the probability of including each element of the population in a sample is not known (Bless, Higson-Smith & Sithole, 2013:166). This type of sampling does not include any form of randomisation for the selection from a population, instead, the researcher used accessible participants, who are Technology teachers. The population in this research stud, therefore, consists of Technology teachers who work in the 26 public schools in the Nkangala Sub-District of the Mpumalanga Province. In Nkangala Sub-District, there were 78 Technology teachers from 26 schools in four circuits at the time of the investigation.

4.6.2 Sampling

According to Polit and Beck (2008:339), sampling refers to the process of selecting a portion of the population so that inferences about the population can be made. The target sample consisted of eight schools and fifteen Technology teachers of whom three withdrew from the interviews. The researcher purposively selected the participants based on the fact that they were information-rich (Creswell, 2014:206) as they had reasonable teaching experience and appropriate subject knowledge as depicted in table 4.1. However, the information-rich participants were selected based on their teaching experience and the qualifications they have acquired for teaching Technology Education. Similarly, Creswell (2012: 145) explains that this sampling approach is considered when a researcher selects individuals because they are available and also have some attributes that the researcher intends to study. Purposive sampling was used in selecting the teachers. With this type of sampling, the researcher selected participants from the population who were informative about the subject under investigation. The teachers teaching Technology were therefore best suited to provide the needed information to address the impediments that they experience in teaching the subject.

Table 4.1: The summary and structure of sampled schools

Name of circuit	**School name**	**Number of teachers**	**Grades**	**Teaching experience (in years)**	**Academic qualifications**
Nokaneng	Rakau Middle School	1	8	19	Diploma (in Mathematics)
	Mapala Secondary School	2	8-9	29	Diploma (in Biology) ACE (in Technology Education)
Mmametlhake	Mpoko Middle School	1	8	20	Diploma (in Physical Sciences)
	Mmametlhake Secondary School	2	8-9	28 2	ACE (in Mathematics) B. Ed (in Physical Sciences).
Marapyane	Mammatli Middle School	1	8	27	Degree (in Biology)
	Dikgabo Secondary School	2	8-9	26	Diploma (in Social Sciences) ACE (in Technology Education)
Libangeni	Semonate Middlle School	1	8	24	ACE (in Technology Education)
	Mbhuduma Secondary School	2	8-9	23 21	Diploma (in Biology) ACE (in Technology Education)

As shown in table 4.1, twelve Technology teachers were selected from Grades 8 – 9, i.e one teacher per grade per school per circuit. Some of their qualifications are in Technology and some are for other subjects. In this instance, the focus was on the participants who were information-rich rather than representative. Information-rich refers to Technology teachers who use strategies, and teaching methods and give feedback to learners to promote learners' thinking. (McKenney & Visscher, 2019:130). Through understanding and the use of teaching methods and strategies in the classroom, Technology teachers who experience impediments in their teaching will be able to implement Technology effectively. Furthermore, they will be able to identify the impediments they are faced in the teaching of Technology. These participants had teaching experience, and, in this regard, they would be able to respond to the interview questions relating to the impediments associated with teaching Technology. Bransford, Brown and Cocking (2004:188) posit that Technology teachers with rich information were required to have a deep understanding of the subject matter and its structure, as well as an equally thorough understanding of the kind of teaching activities that help students with the subject matter in order to be capable of asking probing questions. Successful teachers are responsible for the subject they teach and create engaging tasks that give students meaningful work to do (Darling Harmond, 2016:84). Purposive sampling was used to select them. With this technique, participants are selected on the basis that they can best provide an understanding of the phenomenon under study (Creswell, 2014; Saunders et al., 2012).

In this case, the researcher used the information provided by the principals to select the participants which was based on the preliminary investigation relating to who was teaching the subject from the selected schools and made a judgment as to who should be selected to provide the information to address the purpose of the research. The criteria for selecting the participants were based on the fact that they were teaching Technology in their respective schools in Grades 8 – 9 classes. They had a 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 impediments faced by teachers in the teaching of Technology.

4.7 THE DEVELOPMENT OF THE RESEARCH INSTRUMENTS

The development of the research instruments emanated from the detailed literature review. The constructs of the theoretical framework also guided the structure of the instruments. To ensure

that the research questions are answered, table 4.2 served as a guideline to develop the interview protocol. The table is based on the research questions set out for the study, considering the constructs.

Table 4.2: Development of research question and construct

Research question	**Construct**	**Specific question(s)**
How can the impediments faced by Grades 8 – 9 Technology teachers in Nkangala Sub-District be overcome?	• Training and development • Learning support material • Resources • Class size • Teaching methods • Teaching strategies • Subject matter knowledge • Teacher's PCK • Teachers' understanding of technology concepts	What are the impediments that affect Grades 8 – 9 teachers in teaching Technology?
	• Lack of support from Curriculum Implementers. • Lack of learning and teaching materials.	How do these impediments affect Technology teachers' practice in teaching Technology?
	• Regular interventions with Technology teachers for content enrichment by curriculum implementers. • Provision of adequate learning and teaching materials.	What are strategies through which these impediments can be overcome?

McNiff (2002:40) points out that the research instruments have to always be appropriate to the particular study, and the point of the research instrument must always be to gather evidence for the improvement of practice. Terre Blanche, Durrheim and Painter (2006:51) attest that data

are the basic materials with which researchers work. The main research instruments applied in this study are shown in Table 4.3 below.

Table 4.3 Summary and structure of development of research instrument

Data collection techniques	Number of schools	Number of participants per school	Total
Descriptive observation	Eight schools	One participant to be observed in each school.	Eight participants to be observed
Semi-structured interview	Eight schools	Three participants to be interviewed in each school.	Twelve participants to be interviewed.

4.8 DATA COLLECTION METHODS AND PROCEDURES

The study was conducted in four circuits in Mpumalanga as shown in Table 4.1 above. The four circuits fall under the jurisdiction of the Nkangala Sub-District in the broader JS Moroka Municipality of Moretele East. Data were collected through semi-structured interviews and descriptive observations. The researcher personally visited the research site to conduct the interviews.

4.8.1 Semi-Structured Interviews

An interview as a two-way conversation obtains information through the direct interchange with an individual or a group that is known or expected to possess the knowledge sought (Depoy & Gilson, 2008:108; Saunders *et al.*, 2012:372). Similarly, Collis and Hussey (2014:133) describe an interview as a method of data collection in which selected participants are asked questions to find out what they think about the phenomenon under investigation. Notably, under an interpretive paradigm, interviews focus more on exploring data on understanding, what people think, do, feel, and attitudes (Collis & Hussey, 2014:134). In this sub-section, Cresswell *et al.,* (2016:93) identify three types of interviews and their differences in qualitative research. These are open-ended or unstructured interview, which often takes the form of a conversation with the intention that the researcher explores, views ideas, beliefs, and attitudes with the participant about certain events or phenomena. Participants may propose

solutions or provide insights into events, but the focus is mainly on their own perceptions of the phenomenon being studied.

A semi-structured interview is used in research projects to corroborate data emerging from other data sources (Creswell, et al., 2016:93). It seldom spans a long time period and is usually based on the line of inquiry developed by the researcher in advance. In other words, there are certain open questions that are asked, and these are followed by further probing and clarification. In a structured interview, questions are detailed and developed in advance, much as they are in survey research. The interviewer controls the pace of the interview by treating the interview questions in a standardised and straightforward manner. Thus, all participants receive the same set of questions asked in the same order or sequence by the same interviewer. There is very little flexibility in the way questions are asked or answered in the structured interview setting. Little flexibility emanates from the fact that all participants receive the same set of questions, asked in the same order or sequence, by the interviewer (Creswell, *et al.*, 2016:93). The interview questions are shown in Appendix G.

In this study, the researcher used semi-structured interviews to collect data among the Technology teachers. The researcher used the interview protocol which contained themes and key questions to be covered during the interview. Using an interview protocol is beneficial as no theme or key questions may be omitted. This data collection method enabled the researcher to have probing questions, that is, in case the interviewer wants the interviewee to elaborate. As a researcher, I had to be attentive to the participants so that I could identify emerging lines of inquiry that were directly related to the subject matter taught to explore and probe these. The interviewer encouraged the interviewees to speak freely, demonstrating trust and empathy, while also controlling the process (Heining, Van Rensgurg & Smit, 2008:50).

Prior to data collection, the researcher explained the purpose of the study in order to put the participants at ease. In the course of collecting data, the researcher will write field notes and request the participants to record the interviews. Data collection was guided by a saturation point, and this means that when no new information emerges, there is no need to continue with data collection due to the fact that similar information is obtained from the participants. Based on the researcher's data collection, data saturation started to show by the eleventh participant. According to Romney, Welter and Batchelder (1986:326), this means that a small sample can be quite sufficient in providing complete and accurate information within a particular cultural

context as long as the participants possess a certain degree of expertise in the domain of inquiry. In general, sample size in qualitative research should not be too large, as it might hinder the researcher's process to extract rich data. Theoretical saturation was reached at the 11th interviewee. Since there was only one participant left from the twelve, the researcher decided to go ahead to interview the participant.

4.8.2 Descriptive Observation

The observation was used in this study to collect data in a natural setting by observing and recording the participants' actions and behaviour (Collis & Hussey, 2014:148). In this instance, a descriptive observation was used to observe participants during their teaching, physical setting, their activities, and how they carried out those activities (Saunders *et al.,* 2012:348). The teacher is part of the daily activities of the participants involved in the research project, in a classroom, or any other place where they can meet. Therefore, the researcher decided on descriptive observation as one of the data capturing methods, seeing that certain information can best be obtained by means of direct examination by the researcher. Observation is an important supplement to the actual interviews as it enabled the researcher to detect any disparity among the interviewees. In other words, the researcher was able to see the context and the research site, hence, observation was done in a classroom setting (Bertram *et al.,* 2014). Based on the context of the study, the researcher was able to see what the teachers were doing in the class which could benefit her research.

During this research study, the researcher visited four schools in which the sampled Technology teachers were observed. The descriptive observation method was directed at how Grades 8 – 9 Technology teachers faced impediments in their natural setting. The idea was to observe any constraints present that hindered the teacher in performing his/her task in the classroom. The researcher engaged the observational process by considering the sequence of activities as they occur in a classroom setting and writing a narrative account of the events. The observations were recorded on an observation tool and as a field note, which consisted of a detailed description of events, written shortly after the researcher left the field (De Vos, Strydom, Fourie & Delport, 2011:316). Grinnell and Unrau, (2008:232) posit that field notes should contain a chronological description in categories of what happened to the settings and the participants. The teaching methods were used to comply with the impediments faced by Technology teachers and the context of the classroom in terms of resources (see Appendix F).

The researcher, together with the participants spent the rest of the time allocated for the period on the observation process. Once the researcher had finished the observation, she had to make some sense of her data, hence, data analysis happened concurrently with the collection.

4.9 DATA ANALYSIS

The interview data were analysed using Creswell's (2009:169) framework depicted in figure 4.1. This framework is a manual mechanism for analysing qualitative data. The framework consists of six steps which are briefly explained as follows:

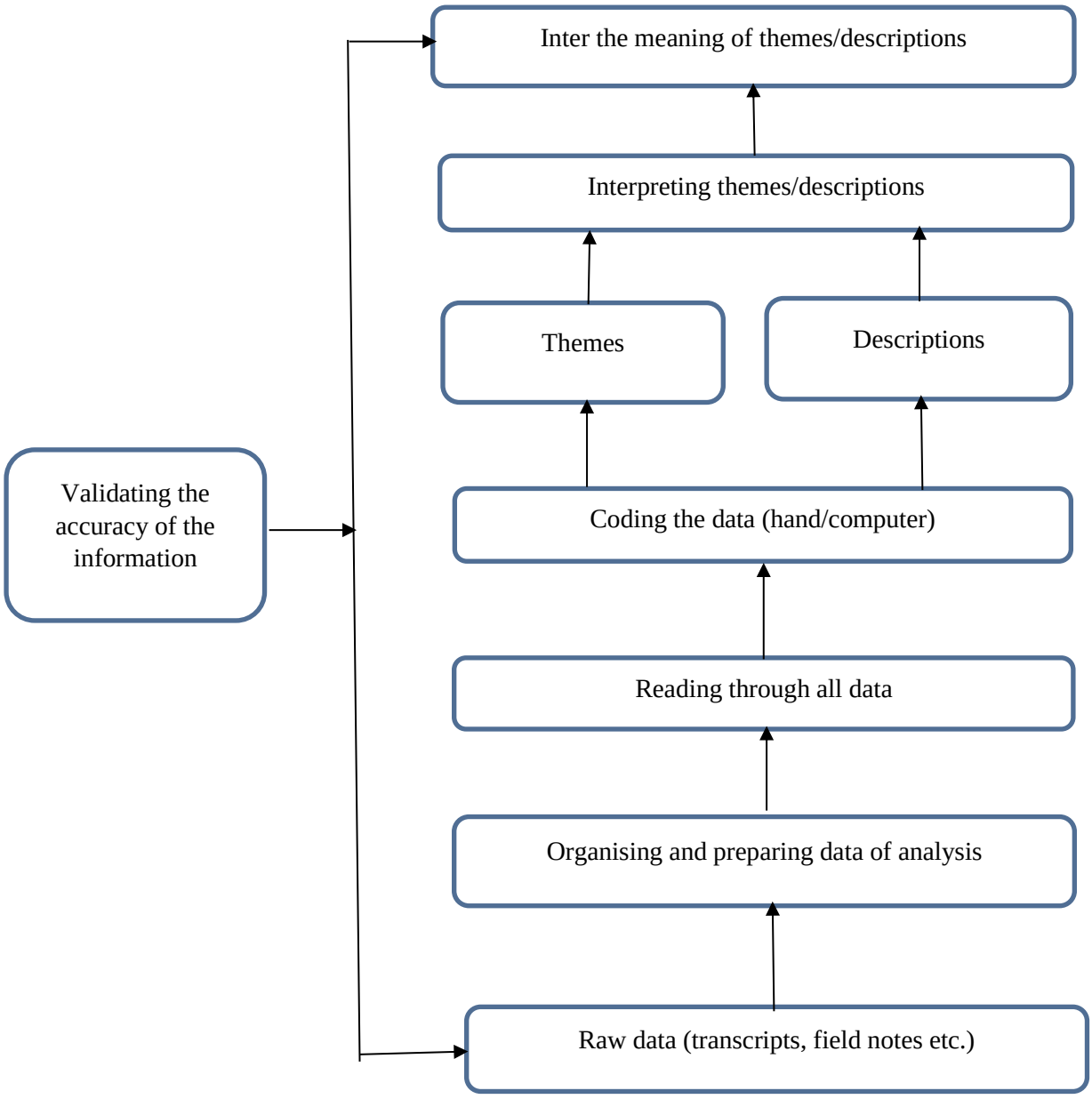


Figure 4.1: Data analysis in qualitative research (Creswell, 2009)

1. Organise and prepare the data for analysis – the researcher first transcribed the recordings and supplemented them with the field notes.
2. Read through all the data – the researcher read the transcripts to get a general sense of the information and reflected on its meaning in totality and some notes were taken.
3. Begin detailed analysis with a coding process – in this regard, textual materials were arranged into segments prior to bringing meaning to information. This process involved the segmenting of sentences, and labeling the categories with terms.
4. Use the coding process to generate a description of the setting or people as well as categories or themes for analysis – this is more of the descriptive process whereby detailed information about the participants was provided and codes generated. Once this was done, codes could be generated, and these would form the main themes used in the findings. These themes demonstrated multiple perspectives from the participants and were usually supported by different verbatim quotations.
5. Advance how the description and themes will be represented in qualitative narratives – this step outlines how the themes that emerged would be presented and narrated to convey the findings of the analysis.

With regards to observation, the researcher used the sticky notes created during the observation. In analysing the observation, the researcher grouped the sticky notes that were related to the same category. Once the categories were finalised, each category was given a label to ensure easy reference. The final step was to rank or prioritise the categories, and from there the researcher linked them with the themes that emerged from the semi-structured interviews. Making an interpretation or meaning of data involved the interpretation of the same. This was done in line with the literature or even theories.

4.10 MEASURES FOR TRUSTWORTHINESS

To ensure trustworthiness, from the twelve participants Technology teachers were observed for 40 minutes and the interview process lasted for 60 minutes. The researcher took 17 hours and 20 minutes to collect data from all participants in their respective schools. Ensuring the believability of the findings is critical in qualitative research and this is a result of the nature of this method, which is regarded as subjective. Researchers view this type of research in terms of how much trust can be shown to the research process and the findings. In carrying out

qualitative research, it becomes important to follow the elements as identified by Lincoln and Guba (1985:301), viz, credibility, dependability, transferability, confirmability, member checking and peer debriefing.

Credibility relates to the truthfulness of the findings. In other words, the findings should demonstrate the truth of the reality under the study. The researcher ensured this element by prolonged engagement. In this case, the researcher stayed in the field until saturation of the collected data was reached. Besides conducting interviews, the researcher achieved credibility by triangulating data across the methods used. For this research study, the use of interview transcripts and observation field notes lead to trustworthiness.

Member checking, also known as respondent validation, allows participants to review findings from the data analysis in order to confirm or challenge the accuracy (Creswell, 2003:196). The researcher took the transcripts to the participants after the interviews to verify if what was said by the participants was well captured. Furthermore, after observation, the researcher verified her understanding of what the participants observed. Peer debriefing involves the process of engaging in a dialogue with colleagues outside of the research project who have experience with the topic, population, or methods being utilised (Creswell, 2003:196). Creswell (2003:196) asserts that the account will resonate with people other than the researcher.

Dependability is interlinked with credibility in the sense that in practice, a demonstration of credibility goes some distance in ensuring dependability (Lincoln & Guba, 1985:301). To enhance dependability, the researcher described and followed a thoughtful analysis strategy as outlined above. This means that all the research steps should be outlined clearly to ensure that there is no need to question. In simpler terms, the researcher would outline how the interview protocol was developed, and how data were collected, audio-recorded, transcribed, and analysed.

Transferability relates to the extent to which the findings of the study can be applied in other contexts or with other respondents (Babbie & Mouton, 2001:277). In order to enhance this element, the researcher will give a detailed description of the context in which data were collected, and any relationship with the participants (Bless *et al.,* 2013:237).

Confirmability is concerned with respondent validation whereby the researcher presented the results of the study to the participants who provided the original data and requested their feedback (Bless *et al.*, 2013:239; Creswell, 2012:47) – member-checking. In other words, the researcher will focus on the audit trail with the participants to confirm the transcripts. The findings adequately and accurately represented their perspectives on the impediment associated with the teaching of Technology. Further to this, a confirmability audit trail can be done to determine the trustworthiness, and this can be done by an independent person by tracing back the raw data (field notes and audio recordings) (Creswell, 2009:192). To enhance confirmability, the researcher presented the transcripts to the interviewees to ascertain their accuracy of the transcripts. In order to increase the study's confirmability, the researcher collected data from the interviews and observations and used the transcripts and field notes as a chain of evidence in the whole research process at the stage when a confirmability audit was done. Based on this, it can be determined whether inferences based on the data are logical appropriateness of labels and the correctness of the interpretation of each theme.

4.10 1 PILOT STUDY

Doody and Doody (2015:1074) define a pilot study as a small-scale version of a planned study conducted with a small group of participants similar to those to be recruited later in the large-scale study. To ensure that the main data collection was done successfully, a pilot study was conducted. Fraser, Fahlman, Arscott and Guillot (2018:262) argue that the term "pilot studies'' refers to mini versions of a full-scale study, as well as the specific pre-testing of a particular research instrument such as a questionnaire or interview schedule. It is fundamental to conduct a pilot study for the following reasons: (i) developing and testing the adequacy of the research instruments, (ii) assessing the feasibility of a full-scale study, (iii) having a possible improvement on the research instrument, (iv) assessing whether the research protocol is realistic and workable, (v) identifying possible logistical problems that might be experienced with the envisaged methods (Moore, Carter, Nietert & Stewart, 2011:332). The pilot study was conducted on three grades, i.e., Grades 7 – 9 Technology teachers. Based on the responses from the pilot study, the research protocol might be amended to address the flaws if any. Pilot studies are not designed to formally assess evidence of benefits and as such, it is usually more informative to provide an estimate of the range of possible responses (Lee, Whitehead, Jacques & Julius, 2014:10).

4.11 ETHICAL CONSIDERATION

The study was carried out in accordance with the University of South Africa's ethics policy. Firstly, the researcher applied for ethics clearance from the Research Ethics Committee. Secondly, permission to conduct the study was requested from the Basic Department of Education's District Office at Mhlanga (see Appendix A). The Nkangala District Office granted the approval for the study (the research approval is shown in Appendix B). Prior to data collection, the researcher applied for permission to conduct the proposed research in the eight schools (see Appendix C). In terms of accessing the participants, the informed consent form was developed which covered information such as (i) the purpose of the study – understanding the purpose would enable the prospective participants to make an informed decision of taking part in the study or not, (ii) the rights of the participants during data collection – a clear indication was provided to the participants that if they are not comfortable continuing with the study, they may withdraw at any given time without providing a reason whatsoever, (iii) the study was voluntary – the participants were informed that the study was voluntary and they would not be forced to participate, (iv) anonymity – as the research might be sensitive, it was important to assure the participants that their names would not be reflected anywhere in the report and as such no personal identifiers would be used throughout the report and (v) confidentiality – all the data provided during the research study were handled confidentially. The participants were requested to sign a letter of informed consent indicating their voluntary participation and knowledge of their rights. The informed consent letter is attached (see Appendix E). This means that access to a participant's data, such as in the form of tapes, interview transcripts and observation field notes was limited strictly to the researcher, the supervisors of the study and the designated examiners. The researcher kept the transcripts in the USB protected with a password (the interview transcripts are shown in Appendix H). Finally, the research could be conducted in terms of ethical principles as provided in the ethics approval certificate, for instance, benefice which compels a duty to the researcher to minimise harm and maximise benefits, and respect for human dignity and this refers to the full disclosure by the researcher as to what the study is all about (Polit & Beck, 2008:172).

4.12 CONCLUSION

This chapter gave a detailed outline of the research methodology used in the study. The focus was on the methods and techniques of data collection and the analysis of data. The research population and sampling were also described as part of the study. Further discussion was made

on the research methodology, data collection, trustworthiness as well as the ethical and legal 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 presentation of the results and interpretation will be made. A brief explanation of how data were analysed will be made and a discussion of the themes that emerged during data analysis.

CHAPTER 5

RESEARCH FINDINGS AND DISCUSSIONS

5.1 INTRODUCTION

The important aspect of data presentation and processing in this study is ensuring that there is evidence of both the data and processes that lead to the findings of the impediments faced by Technology teachers in the teaching of the subject. The collected data are presented and processed with the aim of answering the study's research questions. The collected data were transcribed and coded, and content analysis was applied accordingly to develop themes and categories under which the findings are presented. The commonly used categorisation strategy in qualitative data analysis is coding (Maxwell, 2012:64). Data analysis is regarded as a process whereby the researcher brings order, structure and meaning to the mass of collected data (De Vos, Strydom, Fouche & Delport, 2011:397). For this study, data were analysed using Tech data reduction of open coding. This process was guided by Creswell's (2009:185) six-step approach to data analysis that consists of (i) transcribing interviews, (ii) reading through all the data, (iii) coding the data, (v) generating themes, (v) advancing how themes are represented in the qualitative narratives and (vi) interpreting the meaning of the data. The findings of the research study are discussed. First of all, the profile of the schools is described in the next section to provide a window that facilitates the understanding of the findings. In this regard, data from the twelve interviews were transcribed and carefully read, and the same was done for the observation data. The researcher wrote the essence of the ideas and categorised them into themes.

5.2 PROFILE OF THE EIGHT SCHOOLS

The researcher visited the eight teachers during the winter season of May, June, and July 2021. One or two Technology teachers in each school from the eight schools were observed. The researcher was supposed to have observed and interviewed twelve Technology teachers in all the schools, however, she managed to observe and interview only eight teachers through face-to-face interviews. On 30 June 2021, all the schools were closed as South Africa entered a period of lockdown in response to COVID-19. As a result of the COVID-19 surge, schools were closed, and it was not possible to conduct face-to-face interviews. During the lockdown,

the face-to-face interviews were suspended, and schools remained temporarily closed due to the pandemic (Zalat, Hamed & Bolbol, 2021:2). Therefore, the remaining four Technology teachers were interviewed telephonically due to COVID-19 regulations after the closing of schools and the country being placed under lockdown level 4. Eight Technology teachers were Grade 8 teachers while four were Grade 9 teachers. Not all of these teachers were qualified to teach Technology at the time of the research. Among all the teachers, only four were qualified to teach Technology with proper qualifications and they obtained ACE in Technology. Three of these qualified teachers were teaching Technology Grade 9 and only one was teaching Grade 8. The remaining eight were qualified to teach other subjects such as Biology, Physical Sciences, Mathematics, and Social Sciences, of which six were teaching Grade 8, while two teachers were teaching Grade 9. According to Rakes, Fields and Cox (2006:412), the serious problem facing rural schools is the difficulty in hiring and retaining unqualified teachers teaching Technology. The researcher noticed during the interviews that not all teachers teaching Technology were qualified to teach it.

The eight schools where the research was conducted consist of four middle and four secondary schools. Currently, middle schools no longer accommodate Grade 7 learners but Grades 8 – 9 learners as a phase-out process. Other secondary schools with enough infrastructure accommodate Grades 9 – 12. In Mpumalanga, the restructuring of schools is still in progress. Therefore, the DBE discontinued the middle school structure and incorporated it in the secondary school, but in the context of where the study was conducted, middle schools still exist though integrated with the secondary schools. The restructuring of schools is an attempt to manage the lack of infrastructure in secondary schools. The eight schools are situated in the rural areas of the Nkangala Sub-District which forms part of the broader JS Moroka municipality, which was formally under the Bophuthatswana which had a different schooling system structure. Most of the learners from these schools come from the nearby surrounding villages. The schools are to a certain degree not in a better position in terms of infrastructure, resources, and finance, and as such, they are unable to accommodate the other middle school grades within their premises. The classrooms and resources like teaching and learning materials are limited to be utilised by all learners from Grades 8 – 12 at the same time. In this regard, some of the grades are still at the middle schools. Furthermore, due to COVID-19, overcrowding in classes was visible. To manage the overcrowding, additional spaces were required, and no additional resources were available. To manage the lack of space, the DBE recommended a daily rotational system to be implemented in the schools. According to Teras,

Suoranta, Teras and Curcher (2020:863), COVID-19 with its associated social distancing that followed, affected all walks of society and also education. In terms of social distancing, schools operate in shifts, and this has lowered the learner-teacher ratio. The finding concurs with what Schleicher (2020:21) found in that the World Health Organisation (WHO) forced schools to keep a safety distance of 1.2 meters between learners and teachers to prevent the spread of COVID-19.

A brief description of each teacher follows. All the participants were given a code for identification purposes. Acronyms were used to refer to teachers such as Participant 1 in School A (P1SA), P1SB, P2SB, P1SC, P1SD, P2SD, P1SE, P1SF, P1SG, P2SG, P1SH, P2SH.

5.2.1 School A

School A is a small middle school consisting of 11 teachers and 388 learners. It is situated in a small rural area, a village in the Libangeni area. P1SA is a male teacher with 24 years teaching experience and has acquired an Advanced Certificate in Education (ACE) in Technology Education and is the only teacher responsible for learners in the Grade 8 Technology class. Learners attending the school are from the same village. The content was about the different types of materials. The school lacks resources for teaching and learning such as a Technology workshop to do hands-on activities, textbooks, and technology materials. Since the teacher is committed to his work, he used improvised materials such as tins, boxes, glasses, and plastic bottles when teaching learners and he demonstrated the PCK of the subject. P1SA used box material to demonstrate to learners how to create a structure of a roof. During the Technology period, the teacher rushed to cover the content in 30 minutes. His approach was teacher-centred. In terms of the tasks that required resources, he gave learners projects to complete at home by improvising their own materials. Due to the shortage of textbooks, the teacher provided learners with hand-outs.

5.2.2 School B

School B is the biggest secondary school which consists of 664 learners and 17 teachers. It is situated in a village just a few kilometers from Mmametlhake Hospital and falls under the Mmametlhake circuit schools. The school has two Technology Education teachers. P1SB is a female teacher who has acquired ACE in Mathematics and is responsible for Grade 9 classes. P2SB is also a female teacher who has a B. Ed Hons in Physical Sciences and is responsible for Grade 8 classes. She is a new teacher in the teaching field and was never trained to teach

Technology. The researcher did not observe the teacher, only an online interview was conducted due to schools being closed for the COVID-19 lockdown. Learners attending the school are from the surrounding village. Other learners from the neighbouring villages use public transport to travel to the same school. The content was about different materials and was taught without any textbooks. P1SB understands the subject matter but the lesson was teacher-centred with the talk-and-chalk method due to a lack of resources. No practical work was done with the learners. The content was delivered fast so that the learners could have 10 minutes to administer classwork.

5.2.3 School C

School C is the smallest middle school that is situated on the western side of the village in the Pankop area with 216 learners and 6 teachers. The school falls under the Mmametlhake circuit. Learners from Mocha section travel approximately 2 km to attend the very same school. P1SC is a female teacher and has acquired a Diploma in Physical Sciences with 20 years of teaching experience and was responsible for teaching Technology to the Grade 8 class. The content was about different kinds of structures and learners were sharing textbooks during teaching. Due to a lack of appropriate and sufficient resources and learning materials during the lesson observation, the teacher took learners to the surrounding area in the schoolyard to view different kinds of structures. P1SC and learners spent a lot of time outside the classroom whereby the period passed without administering any classwork. The teacher was not comfortable with the teaching of Technology due to insufficient time allocated for the subject, i.e., 30 minutes per period in a day and three periods per week.

5.2.4 School D

School D is the second largest secondary school in the circuit with 626 learners and 17 teachers. It is situated in the village in the Nokaneng area, isolated from the scattered village and is attended by learners living in the surrounding area. Learners walk a long distance to school and others use public transport. The school consists of two Technology teachers. P1SD is a female teacher who has obtained an ACE in Technology Education and is responsible for Grade 9 classes. The school does not have a Technology workshop to do hands-on activities with the learners and is thus the same as other profiled schools. P1SD improvised for learning materials and during the observation of the lesson, five learners were requested to come forward to touch and feel the texture of the materials they were learning about. They were also requested to name the type of materials such as plastic, glass, paper, metal and fabric. P2SD is also a female

teacher and is responsible for teaching Technology to Grade 8 classes and has obtained a Diploma in Biology. P2SD used chalk and a board to explain the materials and gave learners hand-outs to refer to other materials due to a lack of textbooks. Learners were given a task to do at home to find out about industries and different types of materials produced.

5.2.5 School E

School E is a small middle school and is in the deep rural area in the Nokaneng circuit. It consists of 318 learners and 9 teachers. It is situated in a village in the area of Nokaneng. In terms of infrastructure, the classrooms are limited and due to COVID-19 regulations, the school has separated some learners and put them into a shack. P1SE is a male teacher who has obtained a Diploma in Mathematics and was the only teacher who is responsible for teaching learners in Grades 8 – 9. P1SE has 19 years of teaching experience and during lesson observation, he did not commit himself to improvising learning materials. P1SE was teaching about the types of structures but due to the shortage of learning materials, learners were requested to share textbooks and could not perform practical activities. The lesson presentation was straightforward, and examples of materials were referred to from the textbook. Only questions were asked during the lesson. He relied on talk-and-chalk and teacher-centred methods. Due to lack of time, learners were promised classwork during the next period.

5.2.6 School F

There are 363 learners and 10 teachers in School F. It is a middle school that is situated in a village in the Marapyane area. It is also one of the schools within the Marapyane circuit. Learners attending the school are from the same village, some walk to school, and some are transported by public transport. P1SF is a male teacher and is responsible for teaching Technology to the Grade 8 class and has acquired a Degree in Biology with 27 years of teaching experience. Though the school lacked resources, the teacher demonstrated an understanding of the subject matter by developing models to illustrate the types of structures during the lesson observation. P1SF tried to involve the learners in the lesson by requesting them to identify which structure is rigid and which is not by compressing and feeling the texture of materials. The teacher also used oral assessment to assess the learners by asking questions. Due to a shortage of time, learners were promised a written task in the following period.

5.2.7 School G

School G is a secondary school that is situated in the far North of the Marapyane area and consists of 422 learners with 12 teachers. It is one of the schools within the Marapyane circuit. The school has two Technology teachers. P1SG is a female teacher who has an ACE in Technology Education and is responsible for Grade 9 classes. P2SG is responsible for Grade 8 classes and has acquired a Diploma in Social Sciences. Learners attending the school are from the surrounding village. Though the school lacked resources, the lesson was learner-centred. P1SG requested learners to make different structures using wooden sticks. P1SG evaluated which structure is strong and which one is not by pulling a scale underneath against them. She gave learners homework for assessment. The lesson was learner-centred and due to the limited time, the teacher could not give learners a written task. P2SG was not observed due to the closing of schools regarding the COVID-19 lockdown. Only online interviews were conducted.

5.2.8 School H

School H has 590 learners with 16 teachers. It is situated in the Libangeni circuit. The school has two Technology teachers. Learners attending the school are from the informal settlement in the surrounding area. P1SH is a female teacher who has acquired an ACE in Technology Education and is responsible for Grade 9 learners while P2SH acquired a Diploma in Biology and is responsible for Grade 8 learners. Both P1SH and P2SH were not observed, only online interviews were conducted due to the closing of schools due to the COVID-19 lockdown.

5.3 FINDINGS FROM OBSERVATIONS

This section presents the findings from the observation data. Table 5.1 represents what transpired during the observation in the classroom to facilitate the understanding of the findings.

Table 5.1: Synopsis of the classroom observations

Observation data		
Aspects observed	**What happened**	**Examples**
Active involvement of learners	The teacher showed learner types of materials and encouraged them to take part in the lesson.	P1SA: Asked learners to identify types of materials improvised by the teacher.

Observation data		
Aspects observed	**What happened**	**Examples**
	The teacher involved all the learners by encouraging participation.	P1SC: Asked learners to move out quietly from the classroom to see kinds of structures.
The teacher's demonstration of knowledge of subject matter	The teacher demonstrated knowledge of texture of materials; allowed learners to take own initiative to learn. Understood the concept she was teaching and gave relevant examples.	PISA, P1SD: Understood the topic; asked learners to touch and feel the texture of materials they learned about. P1SB: Plastic, glass, metal, wood and cardboard

The researcher observed the teachers' teaching practice that took place in the usual settings, the schools. Of the twelve Technology teachers interviewed, only eight were observed. The participants focused on the teaching of Materials and the Rigidity of structures as they were topics discussed during the observation period. The lesson observation took 30 minutes per period where the researcher observed how teachers involved learners actively in the classroom, how they demonstrated their knowledge of the subject matter, and the use of appropriate resources for practical demonstrations. Furthermore, varying the teaching methods and the use of assessment to evaluate learners were also observed.

However, the findings presented a different picture in terms of some teachers' efforts. Though they lacked resources, they managed to perform some practical activities. They involved learners in the lesson by improvising for resources to perform hands-on activities in the classroom. They even went the extra mile to involve learners by searching for information on the internet to assist them and teach Technology effectively. The situation forced the teachers to photocopy parts of the textbooks to cater to all learners in the classroom.

While findings from the observation confirm the interviews, especially in terms of the shortage of resources, teachers did not sit and wait but identified the opportunities where they could collect some teaching and learning aids to change the impending situation.

5.3.1 Active involvement of learners

The findings revealed that P1SA, P1SC, P1SD, P1SF, and P1SG involved learners in the classroom by using improvised resources and discussing the texture of materials. There was continuous questioning throughout the lesson of structures by the teacher. Other questions were asked prior to the actual lesson to reflect on the previous work. The teacher asked learners questions such as: What types of structures are these? What are the structures used for? Learners were also given the opportunity to share ideas and ask questions that they did not understand. P1SB, P2SB, and P1SE did not involve learners much in the classroom. Much of the talking was done by the teachers who focused more on the textbook. The textbook that participants preferred to use in the classroom was Platinum Technology which teaches about types of structures. The teachers focused on the stiffening of the frame structures for square frames and triangular frames. After the lesson, the participants immediately gave learners feedback on the task given. Due to lack of time, teachers did not manage to administer any classwork but gave learners homework and projects to do at home. This observation concurs with the findings of the interviews where some of the teachers indicated that the time allocated to Technology is not adequate to teach the subject and as such, they rush through the subject matter just to complete the lesson.

5.3.2 The teachers' demonstration of knowledge of the subject matter

The researcher observed that some of the teachers struggled to teach the subject. Most of the participants were not conversant with some of the Technology concepts. P1SB, P2SB, and P1SE did not have confidence in themselves, due to a lack of knowledge of Technology concepts. They were ill-equipped to function within the new curriculum. It emerged from the analysis that, P1SA, P1SD, P1SC, P1SF, and P1SG possessed a deep understanding of the subject matter by identifying the texture of different materials by giving relevant examples such as metal, plastic, wood, glass, and cardboard. The hands-on activity took place in the classroom through the use of improvised materials such as plastic, paper, glass bottles, and metals. Other types of structures were referred to from the textbook and by drawing them on the chalkboard, such as sculptures, movable transport with wires, and plastic mats. The rigidity of structures was also demonstrated by pulling different structures against two tables and

compressing them by using weights. The participants used improvised materials to perform practical demonstrations. The observation as articulated above is in line with what the teachers indicated in the interviews that there are unqualified teachers teaching Technology. This is more common in rural schools whereby schools experience a shortage of well-qualified teachers, as more experienced teachers move to more desirable schools, particularly in the urban areas (Du Plessis & Mestrey, 2019).

The analysis also indicated that P1SB, P2SB, and P1SE did not possess a deep understanding of the subject matter. The participants used the chalk-and-talk method by only making drawings on the chalkboard and learners remained passive throughout the lesson. They did not even use any textbook to teach them about different materials. Participants did not improvise on any kind of resources to perform hands-on activities with the learners. Teachers who have comprehensive knowledge of their subject matter, convey the message and let their students actively participate in the lessons (Hotaman, 2010:1417).

5.3.3 The use of appropriate resources for practical demonstrations

During observations and interviews, the researcher noticed the lack of sufficient resources and learning materials. Schools are not sufficiently resourced in terms of Technology workshops and learning materials. Due to the resource constraints from the Department of Education, schools had insufficient funds to buy teaching materials and other equipment for teaching Technology. This is also an impediment in the teaching of Technology which restricts the learners' self-learning abilities. P1SA, P1SF, P1SG, and P1SD improvised on the types of materials to show learners how they differ from each other such as tins, glass bottles, plastic bottles, and boxes. P1SB, P1SD, and P1SE did not use any teaching or learning aids to perform practical demonstrations with the learners. Only drawings were presented on the chalkboard. The lesson was teacher-centred. The teachers lacked resources such as textbooks and only used hand-outs to teach learners. No practical demonstrations took place in the classroom. In terms of the findings, today's learners would prefer using computers to be active participants and to develop knowledge during practical demonstrations in the classroom. This observation contradicts the finding of McLain (2021:3), that practical demonstration is a fundamental pedagogical tool in practical subjects, for the development of learners' procedural knowledge, from observation and imitation to autonomy and adaption of a technique.

5.3.4 Varying the teaching methods

Technology is a subject with unique content but is unfamiliar to most teachers. The researcher found that teachers lacked the necessary competencies to facilitate it properly. The analysis indicated that P1SA, P1SC, P1SF, and P1SG used group discussion and class discussion before and during the lesson to deepen their understanding. Group discussion involves participants who discuss a topic and give their own findings. Class discussion is when the teacher discusses the topic with all the learners in the classroom. Facilitating the group interaction in learning activities needed both teachers' extra skills and tools for sharing and interactions to provide significant support and facilitation to education and learning (Tuma, 2021:232). P1SG asked learners to hang weights on their different structures between desks to test their strength. At the end of the lesson, they came together as a class to discuss their findings. They evoked high-order thinking skills and asked thought-provoking questions for learners to think deeply and to find out in detail about what they were taught. The teacher kept on asking learners questions before, during, and after the lesson to keep them on track with what was taught. The participants asked questions such as: What happens when you push at the sides of the shapes? Describe how you can modify the square shape so that it becomes more stable. They also involved learners in hands-on activities to evaluate the rigidity of structures.

On the other hand, P1SB, P1SD, and P1SE dominated the discussion in the classroom while learners remained passive all the time. Simple questions such as: Have you ever seen frame structures near your home or school? Give examples of frame structures, were asked and only a few learners participated in the lesson. They used traditional teaching methods, such as chalk-and-talk due to the fact that they were not trained in such methods, for instance, learner-centred methods. The teachers used textbooks and chalk-and-talk methods to teach the concept without using any teaching aids. The participants did not administer any tasks to the learners in the form of classwork or hands-on activity. Effective teaching methods require teachers to focus on the learners' activity and task performance rather than just the acquisition of facts (Shirani Bidabadi, Nasr Isfahani, Rouhollahi & Khalili, 2016:177).

5.3.5 The use of assessment to evaluate learners

The researcher noted from the observations that P1SA, P1SD, P1SC, P1SD, P1SE, P1SF, and P1SG assessed learners orally during the lesson presentation and gave them immediate feedback. They also asked questions prior to the actual lesson to reflect on the previous work. After the lesson, they gave learners projects to do at home due to the time allocated to teach

Technology. The participants conducted an assessment as follows: At the end of the lesson, P1SA gave learners a project to complete at home. P1SB rushed time and gave learners short classwork to write while time was still allowed. P1SC, P1SD, P2SD, P1SE, and P1SF conducted questions orally and feedback was given immediately. Learners were not given any task to write at the end of the lesson. The participants promised learners classwork to write during the next lesson due to lack of time. P1SG assessed the learners by giving them an opportunity to test the rigidity of structures by themselves using weights.

The analysis shows that most of the teachers evaluated the learners orally during the lesson and feedback was provided immediately. It was further observed that only P1SA gave learners a project to complete at home, whilst P1SB quickly went through the lesson and thereafter gave learners short classwork. On the contrary, the rest of the teachers conducted questions orally and feedback was provided immediately. These teachers promised students to write classwork in the next lesson. It emerged from the analysis that there was no commonality in the teachers' teaching practice. However, in certain instances, it might be because of the short time allocation (30 minutes) to the subject. The teachers were also using different methods of evaluation which could compromise the standards of teaching the subject. Teachers were teaching the subject differently and this needs to be corrected, since it might compromise the mobility of the learners, more specifically with the transfer of learners from one school to the other. The findings from the observations confirm what the participants indicated during the interviews. These are characterised by short periods of 30 minutes, which seems not to be long enough and some of the teachers observed did not complete the lessons, which could mean that the time allocated is inadequate. There are different assessment methods such as oral tests, open questions, observations, exercises in and after class in the assessment guidelines, and many more are suggested for use in the assessment of learners' learning (Zhao, Van den Heuvel-Panhuis & Veldhuis, 2016:4). According to the findings of the present case study, not all teachers provide learners with feedback that focuses on what the learners learned, the progress they made, their potential, and where they need to improve. The effectiveness of teachers' use of assessment is that it can lead to improved learner achievement and teachers gaining more useful information on their learners' understanding and skills. This allows them to subsequently adapt their teaching to their learners' needs (Veldhuis & Van den Heuvel-Panhuis, 2020:451).

5.4 FINDINGS FROM INTERVIEWS

There are many ways to analyse data and the researcher must select his/her own analytical way of intellectual craftsmanship. However, the observer records specific behaviour without making judgments in a more global sense (McMillan & Schumacher, 2010:208). In this section, findings from the interviews are presented, followed by findings from the observation in the next main section. A description of the analysis emergence of themes is given. As a result of the analysis, the following themes emerged:

- Impediments faced by Technology teachers.
- Impediments impacting teachers' practice.
- Teachers' response to the impediments (teaching strategies).

To improve reading or identification of information, it is important that various codes and themes that emerged from data analysis are tabulated. Using these, it was possible to outline and draw conclusions from the consolidated data and portray an informed picture of the teachers' views, options, and expressions relating to the impediments faced by Technology teachers in the teaching of Technology. Table 5.2 provides themes and/or categories of data that participants provided from sources such as interviews. The researcher used this process and was guided by the six-step approach to data analysis as identified by Creswell (2009:186).

Table 5.2: Demonstration of data analysis done from the transcriptions

Interview data		
Analysis steps/strategy	**Themes**	**Examples of verbatim**
Reading and reading through the transcripts for the researcher to familiarise herself with the data; coding words and/or phrases and according to emerging patterns	**Main theme 1: Impediments faced by teachers** Sub-theme 1: Curriculum Implementer/Subject Specialist	"Though we do not have a Curriculum Implementer to support teachers in Technology Education in Nkangala Sub-District, teachers meet as clusters to facilitate Technology" (P1SA).

and categories; building towards themes and sub-themes.	Sub-theme 2: Unqualified teachers	"At our school, the Head of Department (HOD) is unqualified to teach Technology, hence, no curriculum support is received from the school. The only support I receive from the school is when the HOD visits in the classroom to monitor the progress of my work" (P1SA). "The training of educators is important because most of us are unqualified to teach Technology. We just teach the subject just because we don't have relevant teachers to teach it". P1SD
	Sub-theme 3: Resources/Learning support materials and lack of funds	"We experience a shortage of textbooks, and most of them are dilapidated and teachers are forced to make photocopies to give learners hand-outs to read during the lesson. To add to that, most schools in our Sub-District do not have laboratories and workshops to perform practical work, hence, the teaching of Technology ends up being teacher-centred" (P1SA).

5.4.1 Theme 1: Impediments faced by Technology teachers

Teachers were asked about the impediments they are faced with when teaching Technology. These impediments are discussed under the sub-themes below.

5.4.1.1 Curriculum Implementer (CI)

The spotlight in this section falls on the absence of Curriculum Implementers (CIs) who are expected to give support to Technology teachers. The findings revealed that teachers are affected by the absence of CIs in the whole Nkangala Sub-District. This is what P1SG said: *It becomes difficult for us to do the work without someone from above who is more knowledgeable and to guide us on what is expected from us. I am guided by the ATP when teaching Technology, but it doesn't mean I am doing everything correctly. I need to be monitored and guided so that I become sure of what I am doing* (ATP stands for Annual Teaching Plan). P1SG's assertion suggests that things could be done wrongly as no guidance was received from CIs. This is exacerbated by no training that some teachers have in the subject, *as I have indicated that Technology teachers are not trained to teach the subject, I am not quite confident with assessing learners and what to record and what not to record. Even now we did not attend any Technology workshop* (P1SH). Despite lack of training, teachers are on the job anyway, and they should be seen to teach. As a result, *as teachers, we have to use our own experience* (P1SG). The absence of CIs means that the work of teachers is not even monitored. P1SH expressed this concern: *The other impediment is that of not having a Subject Specialist to monitor the teachers' work.*

All the same, teachers "cried" for support, as P2SB stated: *We need support, that's what I gather. So, when we don't have CI's, that's when we won't get teaching structures, ATP's and all the lesson plans so that we can be effective with the work that we do.* According to P1SF, lack of support throws the work of teachers behind, *we always are behind schedule. In Nkangala Sub-District, we don't have a CI who must come to support us, to moderate us, to just solve so many problems that we come into contact with. So, we just teach and teach not knowing where we are, what we are doing*".

The researcher noted from the interviews that teachers in the Nkangala Sub-District do not attend workshops. This situation is linked to the absence of the CIs, as the teachers' views were that it is the cause of the non-attendance of workshops. This impediment causes teachers not

to be effective in their teaching of Technology. P1SD mentioned that *we also experience handicaps in teaching this learning area because we don't have the opportunity to attend workshops because in our circuit, we don't have a Curriculum Implementer for Technology.* According to P1SD, Technology Education as a subject *is not regarded as the core subject like they do with other subjects,* which adds to the impediments that teachers' experience. This situation tends to make teachers lose hope and approach their work as a mere play or force time with learners, as P1SC stated, *the main impediment right now if they would give me Technology, I am just going to play with the learners. We would make whatever we make but it won't be of benefit to the learners because I don't understand what I am doing since I am not trained to teach Technology*. P1SB also said, *we just do the work on our own.*

Given their situation, the teachers place their hope firstly in cluster meetings, *only cluster meetings within our circuit to assist each other* (P1SG). Secondly, the teachers' hopes are placed on Heads of Departments even though they themselves (i.e., Heads of Departments) also lack the subject knowledge, a situation which leads to the blind leading the blind, *we are only assisted by our Departmental Heads in schools who also do not have the curriculum knowledge for teaching Technology Education* (P1SA). At this juncture, P2SD reiterated the importance of having Subject Advisors, *though I have experience in teaching this subject, I don't think I have enough understanding of the subject itself. We need Subject Advisors to take us on board. Lack of knowledge and skills is another factor*. This teacher also re-emphasised the need for teachers to be professionally trained so that they can be confident in teaching the subject of Technology.

It emerged from the analysis that the lack of skilled and qualified Technology teachers and Technology Subject Specialists is the main impediment to the successful implementation of Technology Education in Nkangala Sub-District schools. The analysis revealed that teachers are affected by a lack of support from CIs during their teaching practice. From the interviews, however, both qualified and unqualified Technology teachers' practice is mostly affected by the absence of the CIs. As a result, teachers still struggle to implement Technology Education effectively. This is quite unfortunate considering the fact that it is now 23 years since Technology Education was introduced in the curriculum as a subject. One would have expected teachers to have been trained and thus well versed in the teaching of the subject and well supported by CIs – the concern about CIs stands out in this finding. Hence, this finding attracts Tshiredo's (2013:4) claim that "there is a need for support from Technology subject advisors

to monitor the process of the curriculum in every school". According to Chigona (2017), Subject Advisors are expected to be the masters of pedagogy and CK in curriculum delivery. Hence, they should be available to attend to the needs of teachers. DBE (2013:11) describes subject advisors as "specialist office-based educators in a district office or circuit office whose function is to facilitate curriculum implementation and improve the environment and process of learning and teaching by visiting schools, consulting with and advising school principals and teachers on curriculum matters". However, the researcher learns from the findings that CIs do not come out of their offices to reach out to teachers who desperately wait for their on-site assistance. The literature presents a different perspective, for example, Sedio (2013:4) says that the nine provincial Departments of Education are responsible for executing the national policy by providing training for the Curriculum Implementers (CI's) who are responsible for presenting the teacher-training workshops. Gumbo (2018:129) relates the impediments that contribute to poor understanding of Technology, as exacerbated by the lack of advice and assistance by senior teachers, lack of regular meetings for Technology teachers, and insufficient funds. Furthermore, Makgatho (2014:3688) emphasises that it is the responsibility of DoE to produce teachers with a deep understanding of the teaching and learning of Technology by ensuring that teacher education and training are intensified. Moreover, Fernandez (2014:79) affirms that "successful" teachers in a given content area, who promote learners' learning, are likely to have well-developed PCK with fewer impediments in that specific content area.

5.4.1.2 Unqualified teachers

The issue of unqualified teachers was briefly touched on from the perspective of the absence of CIs, in the above sub-section. It receives full attention in this sub-section as it emerged as a sub-theme during data analysis. The shortage of qualified Technology teachers is a reality in schools in Nkangala Sub-District and as a result, the envisaged effective implementation of Technology becomes unrealistic. Seven teachers were teaching Technology in Grade 8. They however were traditionally trained as Mathematics, Biology, Physical Sciences, and Social Sciences teachers. In the Grade 9 classes, one teacher was unqualified to teach Technology as he specialised in Physical Sciences. It became clear from the interviews that *the shortage of Technology teachers in Nkangala Sub-District is also a concern, many of them are sourced from other subjects. Therefore, training is necessary for them according to Technology needs* (P2SD).

The analysis indicated that unqualified teachers in Technology Education are not doing well in teaching the subject, as P1SA pointed out saying, *I am the only one who furthered my studies and obtained ACE certificate in Technology Education. The other one has a Diploma in Biology*. It was also indicated that unqualified teachers do not make efforts when teaching Technology because they are not trained on how to teach the subject, *unqualified teachers leave out some of the topics unattended because they are a bit difficult for them with ambiguous terms* (P1SB). Teachers just teach Technology because they have been deployed to teach it in the absence of Technology qualified teachers – they just teach it; *so, the challenge that we face is that being an unqualified teacher who specialised in science teaching and currently teaching Technology, we are not doing it properly. You just tell the learners that you take a red wire and connect it* (P1SC). P1SH added: *Most of the teachers are not even trained to teach Technology and also teach without the relevant qualifications*. This situation suggests the urgency of training teachers as Technology Education specialists. Mapotse (2018) notes unqualified or under-qualified Technology teachers as contributing to the problems of the education crisis in South Africa.

The researcher noticed from this finding that the Mpumalanga Department of Basic Education employs unqualified teachers in schools to teach Technology. This is because of a lack of qualified Technology teachers in the province. This reason is substantiated by P2SG, which mentioned that *in Technology Education, we are experiencing a high number of unqualified and novice teachers who are not trained to teach the subject.* The teachers lack the subject matter knowledge, which is in turn a disadvantage to the learners. According to the reviewed literature regarding unqualified teachers, Williams (2012:34) emphasises that it is a lengthy process for the underqualified teachers to acquire a lot of skills and new knowledge to become professional teachers who are experts in their fields since they are not born with PCK. Fernandez (2014:80) also posits that underqualified teachers require knowledge from different sources, namely personal knowledge, knowledge from initial and continuous training, knowledge of the curriculum, and the knowledge of professional practice to become professional teachers. According to Williams (2012:35), it is important for Technology teachers to attend developmental courses that can help them to conceptualise their professional learning and begin laying a foundation for their own PCK development.

5.4.1.3 Resources/Learning Support Materials and lack of Funds

The researcher learned that some schools in Nkangala Sub-District were under-resourced, causing teachers to struggle to teach Technology. Schools did not have well-equipped laboratories, enough classrooms, and learner support materials. One of the teachers' biggest concerns was inadequate textbooks, laboratories/workshops, and finances. P1SA stated: *We experience a shortage of textbooks whereby most of them are dilapidated* [sic] *and teachers are forced to make photocopies to give learners hand-outs to read during the lesson.* Rural area-based schools seem to suffer more as P1SD mentioned that most schools had no laboratories or workshops to do practical work. In addition, the lack of textbooks contributes hugely to Technology teachers' impediments to teaching Technology. *To add to that, most of the schools in our Sub-District do not have laboratories and workshops to perform practical work, hence, the teaching of Technology ends up being teacher-centred.* In certain schools, resource provision was insufficient to the extent that teachers had to share them, *the Department bought only one Electric Circuit kit to be used by all Grades 7, 8, and 9 Technology teachers in the Circuit* P1SC. This participant added: *The only thing we have is one Technology kit for the whole Mmametlhake circuits. Things have been taken out from that kit box and whatever has been used, can't be replaced. When you go to request the kit, it has nothing.* Management crisis in the sharing of resources does not come as a surprise in a situation like this, hence, the missing items in the toolkit. Waiting for a resource from another teacher is a cause for the delay to attend to the class – learners become the sufferers on the receiving end. P2SG mentioned that *the unavailability of textbooks in our schools is another factor that delays the teacher's progress in the classroom*. P1SC highlighted another impediment, i.e., *if you are going to teach concepts like electronics and electricity, we have nothing to use. Due to a lack of finances in schools, principals are unable to buy resources for teachers to teach Technology*.

The textbook issue also attracted the temptation of teachers to be stuck on textbook-based teaching. They could not look elsewhere for teaching materials that they could use such as in the surrounding environment. Lack of training which was alluded to above could play a role in this situation as teachers might not have been exposed to alternative approaches and to methods of teaching as well as to resources. The findings paint an unfortunate picture of Technology Education, a subject that needs teachers to have equipment in place for hands-on activities with the learners due to its theory-practice nature. The practical side suffers due to a lack of resources/equipment. Hence, for P1SE and P1SF, resources in most of the schools are a problem. P1SG commented that *we have a shortage of resources and learners understand well*

if they touch or see the real objects. The lack of infrastructure in our school is also a concern. When you request tools to do projects with the learners and ask the school to build a workshop for hands-on activities, the principal would say the school is not allocated enough funds. We just have a room full of unused computers.

The analysis revealed that it is difficult to teach Technology in a school where there is a lack of resources, especially Technology workshops for hands-on activities. Teachers have stretched themselves as "good Samaritans" by improvising learning materials. Other than that, *we mostly use chalk and board for classroom activities* (P2SH).

While P2SD felt that *Technology was introduced at the right time, the problem that we are facing is the unavailability of resources to suit the needs of the new Technology subject in our schools*. This is a sign that teachers welcomed the rolling out of the subject but were hampered by the lack of resources to teach it. Due to the lack of resources, teachers concentrated mainly on a teacher-centred approach in their classrooms, hence, they ended up being ineffective in their teaching. Moreover, some Technology teachers were the main source of information in their teaching, with little teacher-learner interaction. In a teacher-centred approach, teachers do not often engage learners in hands-on activities (Cohenmiller, Merrill & Shamatov, 2018). The finding supports Tshiredo (2013:7), who found that an under-resourced school has inadequate skills, materials, technology, infrastructure, attitudes and knowledge to affect the intended change in the curriculum. Olaleye, Ajayi, Oyebola and Ajayi (2017:115) argue that school resources are fundamental for making teachers teach more effectively, the shortage of which affects the academic performance of learners.

5.4.1.4 Redeployment and attitude of teachers

The findings revealed teachers' negative attitude towards redeployment to other schools to teach Technology. Teachers who are redeployed to other schools to teach other subjects, not Technology, perform better. The fact that Technology teachers and Technology Education itself are not regarded as important in schools, adds to teachers' negative attitudes. P2SH said in this regard: *the attitude presented by teachers towards teaching Technology is another problem that needs to be attended to.* P1SC said, *then they take the teacher who is unqualified just like me to teach the subject, without the knowledge, without the CI, without the workshop and also not trained to teach the subject*.

The attitude of teachers was also incited by the fact that Technology became the casualty of the COVID-19 pandemic as it was put on hold for some time when other subjects were not stopped. P1SG confirmed that *due to Covid-19 in the previous year, Technology was suspended as a subject in schools,* and *was reinstated at the beginning of 2021.* Redeployment plus issues such as suspension of Technology Education, in the end, make learners struggle with the understanding of Technology Education, because not every teacher who is redeployed can teach this subject.

Added to the problem is that the subject is allocated to teachers who specialise in other subjects when those who teach it and were actually getting used to it, are redeployed to other schools, not even to teach Technology but other subjects. P1SA and P2SH emphasised that teachers in Nkangala Sub-District were faced with a redeployment crisis. According to these participants, DBE only considers the process of LIFO (Last-In, First-Out) and forgets about the learners' needs. The less importance given to Technology Education seems to make Technology teachers targets of redeployment, compared with teachers of other subjects. P1SD had this to say: *Technology Education is not regarded as the core subject as they do with other subjects. Teachers teaching Maths, English, and Home Language are not redeployed to other schools but with Technology teachers, they do redeploy. The school where the teacher is redeployed from will be replaced by any other teacher who does not even qualify to teach Technology. The school where the teacher is redeployed to will not consider him/her as a Technology teacher and he/she will be allocated the foundation phase.*

The researcher learned that there are Technology teachers negatively associated with the teaching of Technology, which is attributed to the redeployment of teachers who seem not happy about their redeployment to other schools. Notably, these teachers are not regarded as important in schools, hence, they perform badly. The finding confirms what Bharath (2004) found in the study conducted in the three primary schools in Kwa-Zulu-Natal, where it was found that "educators indicated that they had little or no experience in the subjects allocated to them". This problem was compounded by the fact that managers had little time to assist the new educators. As a result, if the new teachers are not being assisted, the quality of the teaching and learning in these subjects would have been of a lower standard. However, Gumbo and Williams (2014:479) confirm that a Technology teacher has a deep understanding of curricular knowledge and the subject and possesses knowledge and skills that distinguish him/her from the novice teachers. Jones and Moreland (2007:193) claim that for effective teaching to occur,

it is imperative for Technology teachers to have the PCK of the subject matter that will determine their professional competency. This demonstrates the fact that deepening teachers in subject-related PCK is crucial, to making them, competent teachers.

5.4.1.5 Overcrowding of learners in the class

The analysis revealed that most schools in the Nkangala Sub-District have overcrowded classrooms which hinder the desired teaching of Technology Education. P1SA said: *my Technology classroom is populated due to the number of learners who are squashed and prohibits free movement. It is difficult for me to cope with 48 learners in the classroom.* P1SC gave a picture about how many learners in class teachers had*: You have to group learners into groups of ten to twenty in a class of 40 learners. So, we end up being discouraged and we are not doing justice to what we have to help learners with.* P2SB indicated that: *The other impediment is that we are working in overcrowded classrooms of 42 learners which is a difficult situation for teachers*. This participant alluded to the COVID-19 regulations which reduced the number of learners in the classrooms to observe social distancing. According to P1SH, *overcrowding of 38 learners in the classroom disadvantages teachers to give attention to learners with special needs. It also disadvantages learners to pursue their studies with Technology*.

The participants are of the view that overcrowding impedes the effective teaching of Technology because the subject is more practical, which requires close supervision by the teacher to ensure that no learner is left behind. When there is overcrowding, teachers struggle to pay attention to the learners who struggle with the topic that the teacher teaches. West and Meier (2020) claim that a high learner-teacher ratio leads to various challenges that teachers face. Some of the pertinent challenges caused by overcrowded classrooms include didactical neglect, problematic behaviour, and a lack of discipline, as well as negative teacher attitudes (West & Meier, 2020). It is imperative for teachers to use team teaching and peer teaching to overcome difficulties related to overcrowded classrooms rather than just one teacher teaching in a stressful situation (Muthusamy, 2016:18). An overcrowded classroom can be noisy, but it is necessary for teachers to develop routines and guidelines at the beginning of the year on how to keep the noise level controllable (Thompson, 2012:16).

5.4.1.6 Time allocated to Technology Education

The time allocated to Technology Education did not satisfy teachers given what they are required to cover both in theory and in practice per week. According to P1SH, *the time allocated to teach Technology is very much limited.* P2SH added: *Limited time to teach Technology is also an impediment to coping with the teaching and learning of the subject*. The specific time allocated to Technology Education and the issues around it was described by P1SA: *The time allocated to teach Technology is three periods per week. One period is allocated 30 minutes which is 1h30 minutes per week.* P1SC added: *The time allocated to teach Technology is 1H30 minutes per week. In that 1H30 minutes per week, we have to make something*. *Contact time to complete the content, i.e., content versus contact time is inappropriate* (P1SF). There is therefore consensus among teachers that the time allocated to teach Technology is insufficient to cover what is planned for the week. The finding concurs with what NEEDU (2018) advocates, that if learners need 60 minutes to learn and grasp a concept or a skill, and they spend 30 minutes learning it, then they will not master that concept or skill in the time at their disposal. Ordinarily, they will learn half the content they are expected to assimilate or half the skills they are expected to develop. The time (30 minutes) allocated to Technology is therefore too little for learners to comprehend the subject matter. Muthusamy (2015:47) posits that there is no time to monitor activities, give learners individual attention and mark every single book during the lesson.

5.4.2 Theme 2: Teachers' practice

The sub-themes which emerged from this theme include the ineffectiveness of teachers teaching Technology, Teachers' and learners' negative attitude towards the subject, learners' compromised understanding of the subject content by the limited time allocated to Technology, and learners' inability to do their homework due to a lack of textbooks. These are discussed in the next sub-sections. While almost all these sub-themes were touched on in the preceding sections, they receive focused attention in the sections below.

5.4.2.1 Ineffectiveness of Technology teachers

The majority of participants who teach Technology felt that they try their best to do this, but still, they struggle to translate theory into practice effectively. It emerged from the analysis that Technology teachers lack effective pedagogical strategies to realise effective teaching during lesson presentations. *We as teachers are not effective in this subject and cannot reach the*

outcomes, hence, most of us are inexperienced to teach Technology (P1SD). P2SH supported the above statements by saying: *We are not trained to teach Technology, so, it is not possible for us to be effective in our teaching.* Furthermore, P1SA attested that *lack of content enrichment causes Technology teachers to struggle with the understanding of the subject matter which leads us to be ineffective in the classroom.* According to P1SF, *we just teach and teach not knowing where we are and what we are doing*.

The situation of the teachers translates into learner poor performance, as P1SB attested that, when the exams come, learners fail Technology because as teachers, we do not know how to explain some of the topics to them. They find some concepts difficult to explain. So, I suggest that in Nkangala Sub-District we need someone who will move around the schools, who will arrange workshops where we are trained on how to teach the subject. Because of a lack of Technology background, some teachers chose what they could teach and disregarded what they could not. A hopeless utterance was made by P1SB, who observed that teachers are not trained to teach Technology, they just teach it for the sake of completing the Annual Teaching Plan (ATP). The participant indicated, *as I have said, most of the time we don't know whether we are doing the right thing or not. You will even see it when the Grade 9's are writing their external examination. You know poor learners will fail the subject because the poor teacher is also confused. So, if you are confused as an educator, what will happen to the poor learners that are depending so much on you*?

The analysis indicated that some of the topics such as Mechanical Systems are difficult for teachers. P1SB and P1SA agreed that Technology teachers need people who will support and give them more information about Grade 8 and how to teach learners, because some topics are difficult, leading to them skipping the topics, which is unfair to the learners. P1SD added by saying: *We need support, that's what I gather. So, when we don't have CIs, that's when we won't get teaching structures, ATPs, and all that lesson plans so that we can be effective with the work that we do*.

Teachers' ineffectiveness is directly linked to a lack of material resources as confirmed earlier in this chapter. The lack of appropriate learning materials frustrates Technology teachers as well as learners. This also hinders effective teaching insofar as it restricts the learners' visual perspectives as well as self-learning abilities. Projects in Technology are allocated more marks compared to examinations. The majority of learners end up passing Technology due to the

projects. However, some projects do not give a true reflection of the knowledge and skills which learners have. P1SD mentioned that *those who are doing best are those whose parents do projects for them. Those parents are mechanics, maybe. It means that learners themselves don't do their work.* Those who do projects, do not do them correctly, because they do them for the sake of submitting the work to the teacher.

Technology needs skilled people to work with tools. If learners are not trained to develop projects on their own, industries will lack skilled people to produce goods. This can be attributed to the lack of Technology workshops in schools. P1SF mentioned that: *Learners' projects are of poor quality, just because we don't have the resources. If the instruction said you use the plier and you don't have it, it becomes a problem. If you say learners must go with the project home to do as homework the work is not for the learners, we mark the work of their uncles, their fathers, and their sisters*. P1SC supported the above statements by saying that: *learners pass Technology but the unfortunate part of it is the projects that they make, give them more marks. I can further say that as teachers we are frustrated because as I said, the marks will be as if learners do understand because we use rubrics, but it doesn't reflect the truth about what we have in the classroom. I sometimes improvise teaching materials, and sometimes I just teach straight from the textbook.*

The issue of resources was emphasised when **P1SC** stated: *Resources are a challenge in our schools. When you teach these learners and you have to connect something, what are we going to connect that we don't have? We end up not teaching Technology practically. We are teaching it orally. What we are doing in Technology is just chalk-and-talk which affects the performance of the learners.* P1SG stated that: *Since there is a shortage of resources, it is difficult to achieve the expected aim of the lesson.* As a result, there is heavy reliance on textbooks, *learners use textbooks only during learning and teaching in a classroom which poorly affects our progress in teaching Technology effectively* (P1SF). So, they rely only on the pictures from the textbooks. P1SB reported that *due to a lack of technology workshops for practical work in schools, teachers just concentrate on textbooks as the only source of information, hence, we are ineffective in our teaching*. P1SH confirmed this by saying: the *lack of relevant textbooks disadvantages teachers and learners because teachers have to make copies for learners who do not have textbooks. Learners also do not have the opportunity to study on their own since the study materials are not enough to cover all the learners.* P2SH added by saying: *although*

I have ACE in Technology Education, the problem is the shortage of resources. I feel I rather use teacher-centred method which contradicts the needs of the new subject.

Teachers' main task is to perform all categories of teacher knowledge for effective teaching of the subject (Mohammed & Ihsan, 2016:148) but this ends up being compromised by the situation which teachers face in the Nkangala Sub-District. According to Rise and Kitchel (2017:51) and Shulman (1986), PCK is not just an important aspect of teaching; it is the most important knowledge base a teacher can possess and is considered critical for effective teaching. Technology teachers' PCK is lacking a great deal – this leads to their ineffectiveness in teaching the subject. The teachers' situation does not support Shulman (1987), who found that teachers are supposed to know *how* (pedagogy) and *what* (content) to teach, so they can help learners understand the specific subject matter, in this instance, Technology. Hill (2008:372) emphasises that effective teaching requires Technology teachers to have a unique knowledge of learners' technological ideas and thinking which are an important component of teachers' knowledge. However, Technology teachers are still struggling to adjust with both content and pedagogy of the subject (Mapotse, 2018:686). Hence, teachers should be empowered first so that they can be able conceptualise and interpret technology in an expert manner for learners to understand. It is in this light that, for effective teaching to occur, it is imperative for Technology teachers to be immersed in the PCK of the subject matter for their professional competency (Jones & Moreland, 2007:193).

5.4.2.2 Teachers' and learners' negative attitudes towards the subject

The researcher found that most teachers in schools have developed a negative attitude towards Technology, not necessarily because they hate it but because of the impediments surrounding it. Technology teachers are expected to do practical work with the learners and show good performance, which is impossible under the circumstances. This is what P1SE said: *As a Technology teacher, what I have realised is that there's no love of this subject. Technology is not taken into consideration, hence, there's no information that is brought forward towards the educators by a Subject Specialist so that they can develop a love for Technology*. P2SH alluded that, *Technology teachers developed a negative attitude in Technology Education when it comes to practical work because they do not have the resources to conduct those practical activities*. The finding as such supports Kilinc *et al*., (2016:413), who claim that teachers who took educational technology and teaching material courses and attended in-service training were found to have more positive attitudes than others. When teachers are provided with more

technology-related in-service training like the type of important resources in this technological era, their self-efficacy to teach the subject will increase. Once teachers have self-efficacy, there would be effective teaching of Technology as a subject.

5.4.2.3 Learners' compromised understanding of subject content by limited time allocated to Technology

The researcher learned that the participants felt that the 30 minutes allocated per period is not sufficient to teach Technology. Furthermore, the researcher noticed how teachers are affected by the time allocated, to be effective in their practice. P1SD said: *I cannot teach and give learners an activity to assess them due to the limited time. What I am doing is that sometimes I teach for the whole period and the other period will be for assessment. That is why we cannot complete our ATPs*. P1SG supported the above statement by saying: *So, I think the content cannot be covered within 30 minutes per period in three periods per week. Most of the teaching is teacher-centred due to the fact that time does not allow us to teach to the best of our abilities.* Teaching to the best of their abilities may also not be realisable even if time was sufficient, considering other impediments such as teachers' under-development.

The researcher learned that learners sacrificed their time by staying behind after school trying to catch up with their schoolwork, and teachers give them lots of homework to cover the work. P1SB alluded that *learners need to have enough time to do a lot of practical work to instil interest in them to learn Technology. We always rash time to complete our ATPs and do talk-and-chalk while learners are passive in class and end up falling asleep.* P1SC elaborated the situation thus: *even though I can go to the shops to buy something to improvise so that I can show learners how things are done and remember we have 30 minutes to complete the project. While telling them that, this is a……then the period is over. Let's say after showing them what to do, you give them a chance to work on their own. In the class having 40 learners before the period ends, the two learners are struggling to do it, and the whole 38 learners are watching and then the time is over. Then another period will come after two days.*

P1SG explained the challenge that teachers face to teach the Grade 8's due to the compromised foundation that they have from Grade 7: *The Grade 8's … have … no foundation for Grade 7; the Grade 8 educators spent more time trying to link the Grade 7 work with that of Grade 8 by giving them more work to do either as classwork or homework. In the 30 minutes allocated to teach Technology, I summarised the subject matter quickly so that I can have time for practical*

work with the learners (P2SG). The researcher concludes that if these impediments continue persisting and are left unattended, learners will continue to underperform in Technology Education in Nkangala Sub-District schools.

5.4.2.4 Learners' inability to do their homework due to lack of textbooks

The findings revealed that schools lack adequate textbooks to extend the learners' knowledge. P1SA reported: *Shortage of textbooks in schools is also a concern, it disadvantages both learners and teachers because learners can neither do their homework nor read on their own. For us as teachers, we experience a problem because every time during the lesson we have to replace textbooks by giving learners hand-outs and start from the beginning*. P2SG further said: *we experience a lack of textbooks in our schools, and it is difficult to perform all classroom activities due to learners having to share one textbook*. The impediment experienced in this case does not support the importance attached to textbooks, as Mupa and Chinooneka (2015:128) argue that the availability of textbooks appears to be the most consistent factor in predicting teacher effectiveness in the teaching of Technology in schools.

5.4.3 Theme 3: Teaching strategies

Teaching strategies are different methods and techniques that a teacher uses in a classroom to support the learners through the learning process. In many instances, teaching strategies are used to vary the teaching styles to accommodate all learners according to their level of understanding and learning styles. An approach to teaching is a process used by teachers to employ different teaching methods to assist them in making their teaching practice effective. The literature identified a number of strategies that teachers can use in the teaching and learning context, to create a conducive learning environment (Simelane & Mji, 2014:512). Active learning is considered the most effective strategy for efficient teaching which requires learners to engage actively with the learning materials, participate in the class, and collaborate with others (Tuma, 2021:232). The teaching will be more effective if the teacher knows what approach or strategy is most appropriate in certain situations by using a lot of different pedagogical approaches to teach Technology (Rohaan, Taconis & Jochem, 2010:20). Technology teachers translate the general principle of learning to provide a procedural framework for developing and creating a conducive learning environment for effective outcomes to be achieved. For effective teaching, learning theories are considered as a source of applying different instructional strategies as well as a foundation for the selection of specific

strategies (Mohammed & Ihsan, 2016:148). It is imperative for a teacher to choose the teaching strategy most suitable for the concept being taught. Maniraho (2014:22) emphasises that Technology teachers have the ability to teach in a way that makes connections between the learners' prior, current, and future knowledge. However, the findings present a different picture due to the impediments which have surfaced this far.

5.4.3.1 Formation of peer groups

The researched schools and teachers needed full intervention with peer support. As indicated, during the interview Technology teachers meet to support one another. P1SA mentioned that *we elected cluster leaders who usually arrange for meetings to assist each other and to make sure, that we move at the same pace.* The cluster leaders are known to assist teachers, especially the newly employed teachers. Teachers decided to form the circuit cluster committees to that effect. *P2SG: replied that: there is a cluster committee in our circuit. Teachers who do not specialise in Technology are also assisted by the cluster meetings*. P1SD added that even teachers who are unqualified to teach Technology as well as new teachers, get assisted by experienced teachers during the cluster meetings. P1SF added by explaining that *since we don't have the CI to support teachers, we always hold departmental meetings to discuss issues concerning Technology, e.g., the content coverage which is a major issue and make sure that everything must be addressed*.

The findings further showed that there are Technology teachers who love their work and try by all means to do whatever they can to assist and prepare the learners for a better future. Instead of waiting passively in the situation of impediments they face, they have chosen to try to empower themselves by consulting, working together, and searching for information. P2SB confirmed this thus: *To be honest, as a teacher we have to come up with a plan even though we don't have support. So, you can't just rely on CIs only.* P1SC concurred by saying: *As I have said, we are going the extra mile by doing some research and Googling some of the topics or some of the information, it's helping us. In fact, we are trying to get some information outside our circuit, maybe to communicate or contact some of the CIs from another circuit so that they can assist us to be positive and develop love on this subject*. P1SB alluded by saying: *For now, I can say we are just working as a team in our circuit, more especially in the circuit where I am. We call and remind one another of what has to be done and then from there we just continue teaching. As Technology teachers, we are still confused there and there, but with some*

topics we are fine. As Technology teachers, we workshop each other by hosting departmental meetings (P2SD).

In addition to the help that the teachers solicit from each other and externally, they seek assistance from their Heads of Departments (HoDs) even though these HoDs are not knowledgeable in the subject. This is what P1SD said in this regard: *We are only assisted by our HODs who do not even know what to do to assist teachers. They know nothing about Technology Education*.

From the analysis, it emerged that the Technology teachers have a peer group, and they always meet to discuss the subject matter and provide the necessary support to one another. In the peer group discussions, the teachers share matters of common interest. These include, among others the challenges experienced in the teaching of the subject and possible solutions. Muthusamy (2015:19) contends that group work is an effective strategy for managing tasks in an overcrowded classroom. Dewey (2018: 40) affirms that learners should be encouraged to work in pairs and small groups for discussions and for their views and opinions. This would need Technology teachers to have, as part of their PCK, knowledge and skills about group work.

5.4.3.2 Different approaches to teaching

The analysis revealed that group work stimulates creativity and enables learners to share ideas. When they collect resources, it becomes easier for them as they come from different backgrounds with different experiences. Learners learn best within a group, are encouraged to participate actively in the classroom, and can manage the obstacles that hinder their success (Burke, 2011). P1SG alluded that: *I like using group work in my classroom because it makes learners' work become easier especially when doing projects. They collect resources together and are able to reach* [sic] *their outcomes.*

Technology teachers improvised for learning materials to teach Technology due to the lack of teaching materials. The researcher learned that some Technology teachers tried their best to use improvised resources for active learner participation in class and to keep them on track with what they learned. P1SD stated: *We do improvise for teaching and learning materials. We are doing so because you find that projects in Technology are so complicated for learners to do them. Those who are doing best are those whose parents help them or do projects for them. It means learners themselves don't do their work. You know most of our schools are in rural*

areas where there are no laboratories or workshops to do practical work. Some teachers, however, did not employ differentiated teaching methods. In situations where learners did not understand the concept taught, the teacher did not even attempt to utilise alternative methods.

The use of resources prepares learners for the outside world, improves standards of learning, simplifies teaching and learning and takes learners to higher levels through a Continuous Assessment Task as indicated by participants. Learners learn best when they observe their teachers using visual materials such as overhead projectors to explain the concepts to realise effective teaching. Shabiralyani, Hasan, Hamad and Iqbal (2015:227) argue that visual aids are those teaching aids that are used in the classroom to encourage the teaching-learning process, make it easier and motivate learners, as well as to produce consistent performance. Lack of resources further disadvantages both teachers and learners as stated earlier in this chapter. P1SC pointed out that: *If learning materials were enough for the learners, they would also do something on their own. The problem is that when you request the school to buy resources for Technology, the principal would say that the money allocated for the school is not enough. That is why teachers are just teaching Technology for the sake of being one of the subjects at school.*

Once more, it was noted during the interviews that resources can be the most effective way of increasing the learners' and teachers' knowledge. Too much of a teacher-centred approach in the classroom limits learning because it does not leave room for learners to participate actively. *We make sure that learners are receiving the information* (P1SE). *The department should see to it that they provide enough funds for schools to have all the resources to teach and to enable Technology teachers to be effective in this subject. Resources improve the standard of learning, helps to facilitate teaching easily and to make teaching and learning simple* (P1SD).

Since teachers discovered the secret of resources in improving learning, they are going the extra mile for their learners. This was confirmed as P1SG stated: *As Technology teachers, we are ready to work very hard. We improvise by introducing our teaching aids, e.g., sometimes we make our own models like 'stairs' by using own planks, cubic or rectangular sponges and make use of own tools such as pliers and hammers. The school doesn't provide these things and it will not be enough for the learners to use the tape measures and old machines to show the direction of the rotation of gears, i.e. I am talking about synchronising and rotation by using bicycle machines. Again, we ask for new syringes from medical doctors to do pneumatic*

and hydraulic systems. Teachers also use recycled papers, containers, paper and other materials. According to P2SH, *the room that was supposed to be used as a Technology workshop was turned into a storeroom. This teacher was discouraged and ended up doing chalk-and-board method where I could not improvise for learning materials*. According to Maeland and Espeland (2017:194), for good teaching, teachers should improvise to handle challenges in the classroom, with a focus on creativity, critical thinking, innovation and problem-solving, underlining students as active participants and co-constructors of knowledge. The results confirm those of Dahn, Lee, Enyedy and Danish (2021:3), who found that flexible teachers use improvisation that supports them in finding a balance between their teaching and learners, which is key to effective teaching. Dewey (2018:40) alludes that a learner-centred approach provides learners with a degree of freedom in teaching.

5.4.3.3 Work recovery given to learners to complete at home

From the analysis it emerged that due to limited periods allocated for the subject, the teacher is unable to finish the work in class. As stated above, as a result of this, teachers are compelled to give learners the work to complete at home. P1SA gives learners projects to do at home even though the teacher's suspicion is that the learners' parents do the projects on their behalf. They would do better if there was enough time at school for projects and a workshop where they could perform practical work and gain experience in the use of tools. This teacher goes the extra mile to photocopy sections of textbooks for learners who do not have textbooks so that they do not fall behind in the work. This teacher is forced to do this due to the shortage of textbooks in the school. P1SC was frustrated by this situation which *is why we end up seeing Technology as a subject that we just go and be with learners during that period for few minutes. After that, you give learners projects and mini pads. If we were given enough time and had resources, maybe learners who were doing Grade 9 would be employable and do something for themselves*. For P1SD confirmed, *when coming to the issue of time, there's nothing we can do as teachers. The only thing we can do as Technology teachers are* [sic] *to write a petition to ask the Department of Education to reconsider the issue of time*. P2SG usually arranges a one-on-one with learners who struggle to cope with the content to assist them individually. Another teacher, P2SG *gives learners who experience learning barriers a lot of work to become used to the content taught*. P2SB takes the learners' books home to mark them, which interferes with the teacher's chores, whereas P2SH reports early for work to recover their work and stay behind after school, which, according to this teacher, is not safe to be alone in the school premises. Christiansen, Betram and Mukeredzi (2015:10) concur that teachers need to be aware

of the difficulties this causes, so they can take appropriate steps to deal with potential controversies.

The findings from the interviews this far reveal the pertinent impediments that Technology teachers face. Despite the “hopeless” situation which they face, it is demonstrated in the findings that they push themselves to address the situation in a variety of ways.

5.5 CONCLUSION

The chapter focused on the presentation of the research findings as well as discussions in line with the objectives set by the study. Most participants are hampered in teaching Technology effectively by the impediments they face. In terms of impediments facing Technology teachers, a huge gap still exists, which can be viewed as a call for further teacher training and development. Nkangala Sub-District schools are still confronted by the lack of necessary resources for the successful implementation of Technology Education. Most of the participants demonstrated a negative attitude toward Technology Education and the feeling of uncertainty and insecurity are still most common. The strategies that can change the situation of Technology teachers by addressing the impediments which they face to enhance effective ways of teaching Technology as a subject are discussed. The theoretical framework to indicate how effective teaching can take place was also discussed. In conclusion, it can be said that there is insufficient understanding of the teaching of Technology Education and the practices among teachers in the selected schools in Mpumalanga Sub-District schools. In the next chapter, a summary of the study, key findings, conclusions, recommendations, and the limitation of the study will be discussed.

CHAPTER 6

KEY FINDINGS, CONCLUSION, RECOMMENDATIONS, AND LIMITATIONS OF THE STUDY

6.1 INTRODUCTION

In this chapter, a discussion is made on the summary of the study and the key findings of this qualitative study. A further discussion is made on the key findings of the study to show what the essence of the study is. The key findings will be followed by recommendations of fundamental issues of the study that require further attention. Limitations of the study are also presented and followed by the conclusions of the study outlining the essence of what was concluded.

6.2 SUMMARY OF THE STUDY

This study consisted of six chapters and a brief summary of each chapter is presented below.

Chapter 1 presented an introduction and background of the study. The research problem was introduced as well. This assisted in the formulation of the research objectives and a brief summary of the research methodology followed to achieve the objectives.

The researcher presented a theoretical grounding, PCK of the study, in Chapter 2. PCK was justified and unpacked in terms of the dimensions of teacher knowledge, content knowledge, curriculum knowledge, knowledge of learners, and PK. All these elements are fundamental for the effective teaching of Technology as a subject. Various learning models were also reviewed to support PCK.

In Chapter 3, pertinent literature about the impediments of teaching was reviewed. The chapter covered issues related to the professional development of teachers and their effectiveness in the teaching of Technology, teachers' lack of self-efficacy, teachers' shallow understanding of the curriculum, and teachers' underdeveloped PCK.

A discussion of the research design and methodology was done in Chapter 4. A presentation was made on the target population and sample of the study, in this case, teachers teaching Technology in the sampled schools. The researcher further justified and described data collection methods and the analysis of data.

Chapter 5 discussed the findings of the study in terms of the main themes that emerged from the analysis. Each theme was presented separately with its sub-themes.

The next section presents the summary of the key findings from this chapter.

6.3 KEY FINDINGS OF THE STUDY

The study revealed a number of impediments that contribute to the ineffective teaching of Technology in the broader Nkangala Sub-District. Based on the study analysis, the following key findings emerged from the three main themes:

6.3.1 Impediments faced by Technology teachers

The key findings reveal how Technology teachers feel about impediments impacting their practices. The key impediments include the absence of CIs to support teachers which renders teachers to be ineffective in their teaching practices. This key finding shows that the teaching of Technology would be effective if teachers were provided with resources and support by CIs.

6.3.2 Impediments impacting teachers' practices

From the findings, it could be concluded that of the twelve teachers interviewed, four had formal qualifications 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. Even though teachers are offered training, they still feel that the time allocated for teaching Technology is not enough. Teachers can teach the subject, but they have challenges conducting practical work due to the absence of teaching aids for practical work.

6.3.3 Teaching strategies

Teachers are hooked on the question-and-answer method as a common method used in their teaching. They are overwhelmed by the lack of resources and Technology workshops for

performing practical work. The findings reveal that some teachers are still incompetent to teach Technology properly – this leaves a question about the depth of their PCK. This could result in teachers lacking self-confidence in teaching the subject, which will ultimately compromise their teaching. As a result, their lessons were more teacher-centred. The time allocated for Technology (30 minutes) is not adequate especially given the fact that Technology is mainly practical, thus needing more time for practical activities.

6.4 RECOMMENDATIONS

Given the impediments faced by teachers identified in the study and also based on the conclusions drawn, this section provides recommendations on how the teaching of Technology could be improved against the impediments which teachers face. These recommendations are thus:

- CIs and Technology teachers need in-service training before the actual teaching of Technology. Furthermore, CIs should continuously support Technology teachers in order to improve their classroom practices.
- DBE should provide resources, especially to the rural schools so that effective teaching of Technology can be realised.
- There is a need for DBE to develop a year plan for the training sessions of teachers who are already in the field, to be retrained on recent discoveries regarding the use of teaching/learning resources such as overhead projectors, computers, pliers, and so forth.
- Schools should employ qualified teachers who have knowledge of teaching Technology.
- As Technology is more practical, more time should be allocated to the subject to ensure that the work plan is completed.
- Technology teachers with appropriate Technology qualifications, knowledge, skills and competency should be allocated to teach Technology. This would ensure that the teachers exert themselves well on the subject as they will be properly trained on the PK of the subject. This would enhance quality teaching.
- Teachers should be more interactive in their lessons and avoid being teacher-centred. A teacher-centred approach limits learner participation and with the recent teaching strategies, learners should play a major role in their learning.

- Teachers who are interested in teaching Technology should be supported to enrol for studies that would qualify them in Technology. Providing formal training would ensure that teachers understand the subject matter much better compared to a mere brief workshop.

6.5 CONTRIBUTION OF THE STUDY

The findings presented thus far suggest strategies that can be considered to address the impediments that Technology teachers face. The sub-sections below describe the strategies which DBE can act upon and those related to the Technology teachers' PCK.

6.5.1 Action to be taken by DBE

In the light of the impediments which surfaced from this study and which Technology teachers are faced with, DBE should reflect on how Technology in schools is taught. The reflection in question could help DBE to take decisive steps about (i) who can teach the subject taking specialisation into account, (ii) making it mandatory for all the teachers teaching Technology to have Technology Education qualifications, (iii) attending to the shortage of resources in Nkangala Sub-Region schools, (iv) revisiting time allocated to Technology, (v) training teachers adequately, (vi) making sure that CIs provide the necessary support to teachers for content enrichment. Strategies informed by these aspects, which can help change the situation of Technology teachers are described subsequently.

- **Curriculum Implementers (CIs):** DBE should train CIs thoroughly to understand situations about PCK for Technology in various school contexts before they are allocated to monitor and conduct workshops for Technology teachers. They should visit Technology teachers to provide regular support to ensure viable teaching takes place in Nkangala Sub-District schools. They should also be able to initiate improvement plans and provide effective and efficient interventions, which can best suit the teaching and understanding of Technology.
- **Need for resources:** DBE should provide enough funding to schools so that they can afford to buy the much-needed resources. There is a dire need for Technology workshops/laboratories with tools and machines in Nkangala Sub-District schools for learners to acquire requisite knowledge. Furthermore, Technology teachers should have a thorough understanding of the use of such resources to ensure that they are applied

effectively. However, research-based curriculum materials should be made available. The policies which can guide teachers to use standardised resources to improve learners' understanding of Technology skills should be developed.

- **Teaching time for Technology:** DBE should reconsider the time allocated to teach Technology. With this, teachers will be afforded the opportunity to do work recovery, considering the compensation for their extra time spent on teaching Technology. Furthermore, more time will most probably allow teachers enough time for practical work and administration of classwork and the opportunity to provide remedial to learners with barriers.
- **Teacher qualifications:** DBE should audit all unqualified Technology teachers who are already in the field and offer them specially designed professional development workshops. This is because of the unique nature of Technology, e.g., the uniqueness of its methodology of teaching, it is relatively recent compared to other traditional subjects, many teachers are not yet qualified in the subject, and the subject is more practical than it is theoretical. Furthermore, Technology teachers should be encouraged to enroll with FET institutions to acquire knowledge of the subject matter.
- **Redeployment and attitude of teachers:** A need for teaching Technology should be considered a priority in Nkangala Sub-District schools. Most importantly, Technology teachers should not be targeted as candidates for redeployment. They should be allowed to settle and grow their PCK in the subject.
- **Overcrowding of learners:** For effective teaching to take place in a Technology class, the DBE should reconsider the teacher-learner ratio. Teachers can manage a class that has a reasonable number of learners, such as giving learners individual attention, distributing the available resources equally among learners, and monitoring learners' progress. Furthermore, team and peer teaching should be encouraged in teachers.

6.5.2 A focus on Technology teachers' PCK

Figure 6.1 outlines a framework of strategies for Technology teachers.

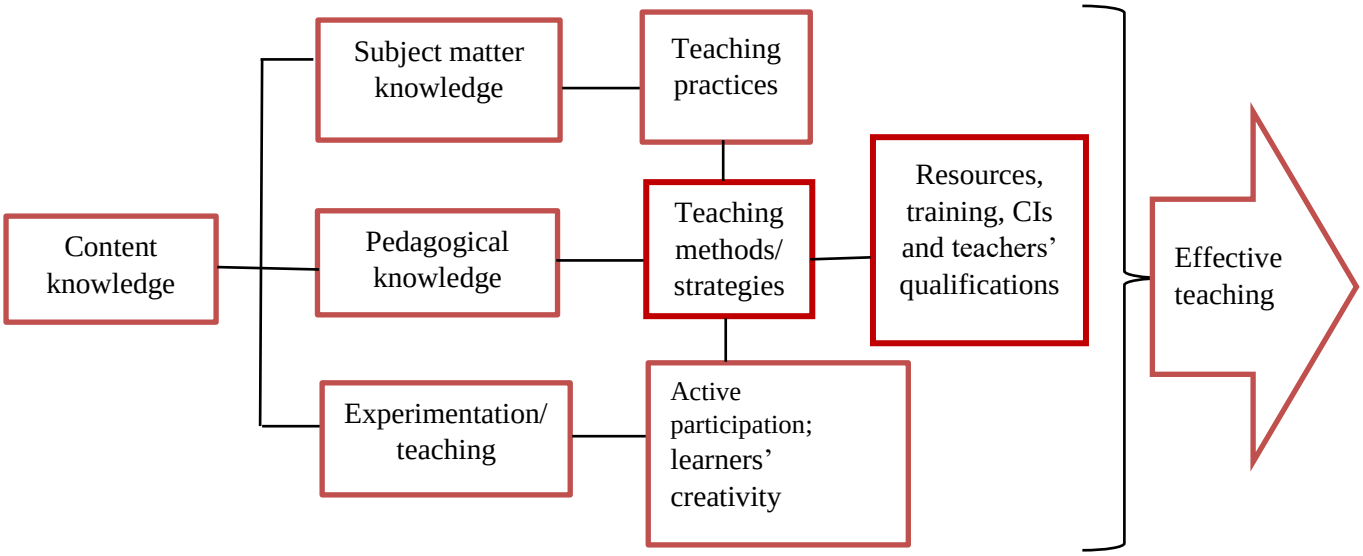


Figure 6.1: Technology teachers' PCK related strategies

Figure 6.1 outlines the strategic efforts that teachers can adopt in order to realise the effective teaching of Technology. It is imperative for teachers to understand CK of Technology to be effective in their teaching. They should make effort to consult resources that can build on their knowledge of the subject in addition to the training intervention that DBE can offer. In this instance, CK refers to the knowledge about the subject matter that is to be learned or taught (Harris, 2009:397). In their effort to "self-teach", teachers should think about the subject matter, PK, and use of learning resources.

Subject knowledge should be demonstrated by teachers during their teaching practices. Teaching practices refer to the teaching and application of Technology concepts. For effective teaching of Technology, teachers should use resources, attend training for content enrichment and receive enough support from CIs. Unqualified teachers should also be encouraged to attend content enrichment workshops and to develop themselves professionally by enrolling in the Technology programmes offered by training institutions. Pedagogical knowledge relates to a deep understanding of subject matter and how to impart it to learners. Teachers should make sure that they understand the design process (dominant method for teaching Technology), how to apply it as well as related methods to improve it. Since Technology is a heavily practical subject, teachers should from time-to-time design learning activities from a practical point of

view. Learners should be encouraged to engage in practical design activities (workshops/experimentation) which will arouse learners' interest and active participation.

It is hoped that the above-suggested framework could assist Technology teachers to teach the subject effectively.

6.6 LIMITATIONS OF THE STUDY

The following limitations are identified:

- The study was conducted in four circuits of the Nkangala Sub-District and therefore, no generalisability of the findings can be claimed. Even though Technology teachers in other contexts could identify with the impediments, it is proper to conduct similar studies in those contexts.
- There is also a methodological limitation of the study and in this regard, a qualitative method was used. A mixed-method could be used in future studies to create a deeper understanding of the topic.
- Technology teachers in the schools were not all interviewed face-to-face due to COVID-19 lockdown, and some cancelled the appointments, therefore they were not interviewed. Future studies faced with similar challenges could engage strategies that can avoid such disturbances.

6.7 CONCLUSION

The study provides important information relating to the impediments of teaching Technology in the selected schools in Mpumalanga. Notably, three fundamental themes described under 6.3 emerged from the study. The findings as presented helped to address the objectives of the study. It is acknowledged that even if teachers would have been fully trained, there is the taught knowledge and the practice knowledge, which needs one to think on their feet in response to how the situation presents itself. Despite this, there is a need for strategies that could empower teachers to exert themselves better in the face of their impediments. It is in this light that the findings created the need to develop the strategies which could mitigate the impediments that Technology teachers face. The main contribution of this study, therefore, lies in the strategies which were developed in Chapter 5.

REFLECTION

The research study was conducted in a short period of time from May to July 2021. I was guided by my supervisor who has a strong potential for assisting his students. Usually, after submission of a chapter, he reverted after one to two weeks with harsh comments on my feedback that made me scared of him, even to contact him telephonically to ask for further clarity. I nearly quit my studies, but I persevered. He kept on encouraging me not to be distracted by the comments written on my work.

Through those comments, I have become a better researcher. Furthermore, I have realised that the comments made me have a genuine knowledge of how to conduct a research study in the future. Prof Gumbo kept on guiding me in my work and pursuing to finish my studies. I kept on responding positively to the comments made to avoid disappointing my supervisor. I realised through the research process that the research study needs time and lot of sacrifice to become successful. I also realised that Technology is not an easy subject, it needs to be taken into consideration. I further learned about the impediments that hinder the effective implementation of Technology in the classroom.

I assumed that participants who withdrew from being interviewed, that is besides the 12 interviewed since the targeted teachers were 15, developed low self-esteem since they know the researcher and were stagnant in their qualifications. The biggest challenge is that they still have a diploma and/or Honours degree acquired from their previous institutions. The participants' interviews were open, and they responded positively to the questions asked.

I experienced financial constraints having to travel a long distance from Gauteng to Nkangala Sub-District schools in Mpumalanga. I was using my own transport having to fill patrol on a daily basis and was unable to buy resources to be used for data collection. I had to visit the bank to assist me financially prior to data collection. I had to sacrifice time for my studies spending sleepless nights and working on weekends. I was working on my research and report for work at the same time. That was not an easy task for me. I made sure that my appointments at various schools started at 11H00 so that I was able to report for work in the morning to avoid being absent.

The study made me realise that the need for teaching Technology in Grades 8 – 9 classes is a priority. I have gained insight that Technology teachers need to be supported in their teaching practices in order to be effective so that the impediments they are faced with are reduced.

LIST OF REFERENCES

Ableser, J. (2012). Exemplary teaching practices across educational context (P-20+): Unifying principles and ecological model for teaching for all to learn. *Journal of Teaching and learning*, 8(2): 66-76.

Aldridge, J., Fraser, B. & Ntuli, S. (2009). Utilizing learning environment to improve teaching practices among in-service teachers' understanding: A distance education programme. *South African Journal of Education*, 29: 147-170.

Aneas, A. (2015). Transdisciplinary Technology Education: A characterisation and some ideas for implementation in university. Studies in High Education, 40(9): 1715-1728.

Ankiewicz, P.J., de Swart, F. & Gross, E. (2001). The Facilitation of critical thinking in a Technology Education Classroom. *Acta Academia*, 33(3):188-206.

Appiah, F.O. (2014). Teaching the design process in the Grade 9 Technology class. Unpublished dissertation. Durban: University of Kwa-Zulu Natal.

Apuke, O.D (2017). Qualitative Research Method A Synopsis Approach. Arabian Journal of Bussiness and Management Review (Kuwait Chapter). 6(10):41-47.

Asunda, P.A. & Mativo, J. (2017). Integrated stem: a new primer for teaching Technology Education. *International Technology & Engineering Teachers*, 14-19.

Babbie, E. & Mouton, J. (2001). The practice of social research. Cape Town: Oxford University Press.

Babbie, E. (2008). *Introduction of social research*. 5th ed. USA: Wadworth.

Ball, D.L., Thames, M.H. & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5): 389-407.

Betram, C. & Chistiansen, I. (2014). Understanding research: an introduction to reading research. Pretoria: Van Schaik.

Bharath, N. (2004). The effects of rationalization and redeployment on the culture of teaching and learning in selected primary schools. Master dissertation, KwaZulu -Natal.

Bless, C., Higson-Smith, G. & Sithole, S.L. (2013). Fundamentals of social research methods: An African perspective. 5th ed. Cape Town: Juta.

Boser, R.A., Palmer, J.D. & Daugherty, M.K. (1998). Students' attitude towards Technology Education Programs. *Journal of Technology Education*, 10(1): 4-19.

Bransford, J., Brown, A. & Cocking, R. (Eds). (2004). *How people learn*: Brain, mind, experience and school. Washington DC: National Academy Press.

Brown, R., Ernst, J., Clark, A., DeLuca, B. & Kelly, D. (2017). Technology education courses and classrooms naturally lend themselves to providing active learning opportunities for students. *International Technology &* Engineering *Teachers,* 30-34. Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? *Qualitative research.* 6(1): 97-113.

Bryman, A. (2014). Social research methods. 3rd ed. Cape Town: Oxford University Press.

Burke, A. (2011). Group work: How to use groups effectively. *The Journal of Effective Teaching,* 11(2): 87-95.

Busby, J.R & Mupinga, D.M. (2006). Requirements, Benefits, and Concerns of Technology Education Cooperating Teachers: An Exploratory Study among Nine Midwest Universities. *The Journal of Technology Studies,* 33(2): 79-86.

Cabrera, A.F. & La Nasa, S.M. (2008). Classroom teaching practices: Ten lessons learned. Alegre: PUCRS.

Chigona, A., Chigona, W., Kayongo, P. & Kausa, M. (2010). An empirical survey on Domestication of ICT in schools in disadvantaged communities in South Africa. *International Journal of Education and Development Using Information and Communication Technology*, 6(2): 21-32.

Chigona, A. (2017). Western Cape subject advisors' perception of their preparedness for connected classrooms. *The Electronic Journal of e-Learning*, 15*(5)*: 444-454.

Cohen, L., Manion, L. & Morrison, K. (2007). Research methods in education. 6th ed. London: Routledge.

Cohenmiller, A., Merrill, M. & Shamatov, D. (2018). Effective teaching strategies: A brief overview. https://www.researchgate.net/publication/325415903. Accessed 26 September 2021.

Collis, J. & Hussey, R. (2009). Business research: A practical guide for undergraduate and postgraduate students. 3rd ed. London: Palgrave Macmillan.

Collis, J. & Hussey, R. (2014). Business research: A practical guide for undergraduate and postgraduate students, 4th ed. London: Palgrave .

Cooper, D.R. & Schindler, S. (2008). Business research methods. 10th ed. New York: Mc Grawhill.

Creswell, J.W. & Plano Clark, V.L. (2007). Designing and conducting mixed methods research. 2nd ed. Thousand Oaks, CA: Sage.

Creswell, J.W. (2009). Research design, qualitative, quantitative and mixed methods approach. 3rd ed. London: Sage.

Creswell, J.W. (2009). Research design, qualitative, quantitative and mixed methods approach. 3rd ed. London: Sage.

Creswell, J.W. (2012). Educational research: Planning, conducting and evaluating quantitative and qualitative research. 4th ed. New York: Pearson.

Creswell, J.W., Ebersohn, L., Eloff, I., Ferreira, R., Ivankova, N.V., Jansen, J.D., Nieuwenhuis, J., Pietersen J. & Plano Clark, V.L. (2016). First steps in research. 2nd ed. Pretoria: Van Schaik.

Crotty, M. (2003): The Foundations of Social Research: Meaning and Perspectives in the Research Process, London: Sage Publications, 3rd edition, 10.

Dahn, M., Lee, C., Enyedy, N. & Danish, J. (2021). Instructional improvement to analyze inquiry-based science teaching: Zed's dead and the missing flower. *Smart Learning Environment,* 8(10): 1-29.

Daniel, E. (2016). The Usefullness of Quantitative and Qualitative Approaches and Methods in Researching Problem Solving Ability in Science Education Curriculum. *Journal of Education and Practice.* 7(15): 91-100.

Darling-Hammond, L. (2004). Inequality and the Right to Learn: Access to Qualified Teachers in California's Public Schools. Teachers College Record, 106(10): 1936-1966.

Darling-Hammond, L. (2016). Research on teaching and teachereducation and its influences on policy and practice. *Education Research,* 45(2): 83-91.

De Miranda, M. A. (2008). Pedagogical Content Knowledge and Engineering and Technology Teacher Education: Issues for thought. *Journal of the Japanese Society of Technology Education,* 50(1): 17-26.

Dewey. J. (2018). Effective teaching strategies: A brief overview. Research gate. 38-52.

Department of Basic Education, South Africa, (2002). Revised National Statement: Grades R – 9. Pretoria: Government Printers.

Department of Education. (2003). Revised National Curriculum Statement Grades R – 9 (Schools): Teacher's guide for the development of learning programmes – Technology. Pretoria.

Department of Education. [DoE]. (2006). The national policy framework for teacher education and development in South Africa: More teachers; better teachers. Pretoria: Government Printers.

Department of Basic Education, South Africa, (2011). Revised National Statement: Grades R – 9. Pretoria: Government Printers.

Department of Basic Education. 2011. *Curriculum and Assessment Policy Statement Grade* 7 – 9: *Technology*. Pretoria: Government Printers.

Department of Basic Education. (2013). Policy on the organisation, roles and responsibilities of Education Districts. Government Gazette No. 36324. Pretoria: Government Press.

De Poy, E. & Gilson, S. (2008). Evaluation practice: How-to do-good evaluation research in Work settings. London: Routledge Tailor and Francis group.

De Vaus, D.A. (2014). Surveys in Social Research. 6th ed. Australia: UCL Press.

De Vos, A.S., Strydom, H., Fourie, C.B. & Delport, C.S.L. (2011). Research at grass roots: *For the social sciences and human service professions*. 4th ed. Pretoria: Van Schaik.

Dichaba, M.M. & Mokhele M.L. (2012). Does the cascade model work for teachers' training? Analysis of teachers' experiences. *International Journal of Education in Science,* 2(3): 249-254.

Doody, O. & Doody, C.M. (2015). Conducting a pilot study: Case study of a novice researcher. *British Jounal of Nursing,* 24(21): 1074-1078.

Dufee, L. & Aikenhage, G. (1992). Curriculum change, student evaluation and teacher practical knowledge. *Journal of Sciences Teacher Education,* 76(5): 493-506.

Du Plessis, P & Mestry, R. 2019. Teachers for rural schools – a challenge for South Africa. South African Journal of Education, 3, (Supplement 1) 81-89.

Du Toit, A. & Gaotlhobogwe, M. (2018). A neglected opportunity: Entrepreneurship education in the lower high school curricula for Technology in South Africa and Botswana. *African Journal of Research in Mathematics, Science and Technology Education.*

Engelbecht, W., Ankiewicz, P. & de Swardt, E. (2007). An industry-sponsored, school-focused model for continuing professional development of technology teachers. *South African Journal of Education*, 2: 579-595.

Engelbrecht, W., Ankiewicz, P. & de Swardt, E. (2007). Technology Education in South Africa since 1998: A shift to decentralised continuous professional teacher development. *Department of Mathematics, Science, Technology and Computer Education*, 2: 1-25.

Fahrman, B., Gumealius, L.B. & Nostrom, P.G. (2015). Technology Education in primary school in Sweden: A Study of teachers' view on teaching strategies and subject content.

Fernandez, C. (2014). Knowledge Base for Teaching and Pedagogical Content Knowledge (PCK): Some Useful Models and Implications for Teachers' Training. *Problems of education in the 21st century*, 60: 79-101.

Fiske, E.B. & Ladd, H.F. (2004). Elusive equity: Education reform in post-apartheid South Africa. Washington: DC: Brookings Institute.

Fox-Turnbull, W. (2016). The nature of primary students' conversation in technology education. *International Journal Designed Education*, 26: 21-41.

Fox-Turnbull, W. (2019). Assisting teachers' understanding of student learning in Technology. *International Journal of Technology and Design Education*, 29: 1133-1152.

Fraenkel, J.R. & Wallen, N.E. (2007). *How to design and evaluate research in education*. 6th ed, New York: McGraw-Hill. Avenue of the Americas.

Fraser, J., Fahlman, D.W., Arscott, J. & Guillot, I. (2018). Pilot Testing for Feasibility in a Study of Student Retention and Attrition in Online Undergraduate Programmes. *International Review of Research in Open and Distributed Learning*, 19(1): 260-278.

Garfield de Waal, T. (2004). Challenges facing teachers in historically disadvantaged schools in the Western Cape. Unpublished thesis. Belleville: University of the Western Cape.

Goundar, S. (2013). Research methodology and research method. Retrieved from: https:/www.researchgate.net/publication/333015026. Accessed 15 August 2020.

Gray, D.E. (2009). Doing research in the whole world, 2nd ed. University of survey: Sage.

Grinnell, R.M. & Unrau Y.A. (2008). *Social work research and evaluation: Foundation of evidence-based practice*. New York: Oxford University Press.

Guba and Lincolin (1989). Fourth Generation Evaluation. London: SAGE Publications, 83.

Gumbo, M.T. (2003). Indigenous Technologies: Implications for a Technology Education curriculum. (Unpublished PhD thesis). Pretoria. Vista University.

Gumbo M.T. (2014). An Action Research Pilot Study on the Integration of Indigenous Technology in Technology Education. *Mediterranean Journal of Social Sciences*, 5(10):386-392.

Gumbo, M.T. (2016). The question of Technology Education: a pertinent issue. Inaugural Lecture. *Department of Science and Technology Education.* Pretoria: University of South Africa, 1-35.

Gumbo, M.T. (2018). Addressing the factors responsible for the misunderstanding of Technology Education with other subject fields. *Perspectives in Education*, 36(1): 128-144.

Gumbo, M.T., Makgatho, M. & Muller, H. (2012). The impact of in-service Technology training. Programmes on Technology Teachers. *The Journal of Technology Studies, 38(1):23-33.*

Gumbo, M.T. & Williams P.J. (2014). Discovering Grade 8 Technology teachers' pedagogical content knowledge in the Tshwane District of Gauteng Province. *International Journal Education of Science,* 6(3): 479-481.

Hartell, E., Doyle, A. & Gumaelius, L. (2019). Teachers' attitudes towards teaching programming in Swedish Technology education: Investigating enacted practice in Design and Technology Education. Retrieved from: https://www.researchgate.net/publication/334326760. Accessed 03 March 2020.

Harris, J., Mishra, P. & Koehler, M. J. (2009). Teachers' Technological Pedagogical Content Knowledge and Learning Activity Types: Curriculum-based Technology Integration Reframed. *Journal of Research on Technology and Education,* 41(4): 393-416.

Heining, E., Van Rensburg, W. & Smith, B. (2008). Finding your way in qualitative research. *Finding your way in qualitative research.* Pretoria: Van Schaik.

Huang, K., Lubin, A. & Ge, X. (2011). Teaching and Teacher Education. *Journal of technology and Teacher Education,* 27(2011): 1200-1212.

Heymanns, J.H. (2007). The implementation of Technology Education in secondary schools in the urban areas of Free State Province. *Interim: Interdisciplinary Journal,* 6(1): 34-39.

Hill, H.C., Ball, D.L. & Chilling, S.G. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic-specific knowledge of students. *Journal for Research in Mathematics Education, 39*(4): 372-400.

Hotaman, D. (2010). The teaching profession: knowledge of subject matter, teaching skills and personality traits. P*rocedia social and behavioral sciences,* 2: 1416-1420.

Ijeh, S.B., & Nkopodi, N. (2013). Developing a Theoretical Model for Investigating the Mathematics and Science Teachers' PCK in South Africa and Zimbabwe. *Mediterranean Journal of Social Sciences,* 14(4): 473-479.

ITEA. (2000). *Standards for technological literacy: Content for the study of technology.* Renston, VA: Author.

Johnson, B. & Christensen, L. (2012). Educational Research, Qualitative, Quantitative and Mixed Approach. 4th ed. Califonia: SAGE Publications.

Jones, A. & Moreland, J. (2004). Enhancing practicing school teachers' pedagogical content knowledge in technology. *International Journal of Technology and Design Education*, 121-140.

Jones, L. & Moreland, J. (2007). The importance of pedagogical content knowledge in assessment of learning practices: a case study of whole school approach. *The Curriculum Journal*, 16(2): 193-206.

Jones, L. & Moreland, J. (2007). The importance of pedagogical content knowledge in assessment of learning practices: a case study of whole school approach. *The Curriculum Journal*, 16(2): 193-206.

Kangai, C. (2014). Teacher development through open and distance learning: The Case for Zimbabwe. *International Open and Distance Learning Journal,* 2(2): 1-18.

Kılniç, E., Başer, E. H., Kılınç, S., Kaya, M. M., Türküresin, H., & Kesten, A. (2016). Teachers' attitudes toward the use of technology in social studies teaching. Research in Social Sciences and Technology, 11(14), 411-424.

Kind, V. (2009). Pedagogical content knowledge in science education: perspectives and potential for progress. *Studies in Science Education*, 45(2): 169–204.

Koehler, M. J. & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education,* 9(1): 60-70.

Kolb, D.A. (1984). *Experiential learning: experience as the source as the source of learning and development*, Eaglewood Cliffs: Prentice Hall.

Korvin, A.R. & Jones, R.E. (1990). Do Hands-On, Technology-Based Activities Enhance Learning by Reinforcing Cognitive Knowledge and Retention? Journal of Technology Education, 1(2): 1-12.

Krauss, S.E. (2005). Research paradigms and meaning making: A primer. *The Qualitative Report*, 10(4): 758-777.

Lankford, E.M. (2001). Teaching IT: A Survey of Terminal Degrees, Hiring and Promotion for Information Technology Professors. http://raven.ubalt.edu/staff/lankford. Accessed 16 April 2021.

Lee, K. (2011). Looking back to look forward: using traditional cultural examples to explain contemporary ideas in Technology Education. *Journal of Technology Education*, 22(2): 42-253.

Leedy, P. & Ormrod, J.E. (2014). Practical Research Planning and Design. 10th ed. Edinburgh: Pearson Educational Inc.

Leppavirta, J., Kettunen, H. & Sihvola, A. (2011). Complex problem exercises in developing engineering students' conceptual and procedural knowledge of electromagnetic. *IEEE Transaction on Education*, 54(1): 63-66.

Lincoln, Y.S. & Guba, E.G. (1985). Naturalistic inquiry. London: Sage Publications.

Loughran, J., Berry, A. & Mulhall, P. (2012). Understanding and Developing Science Teachers' Pedagogical Content Knowledge, *Journal of science and technology*, 12(2):1-23.

Maeland, K. & Espeland, M. (2017). Teaches' conceptions of improvisation in teaching: Inherent human quality or a professional teaching skill? *Education Enquiry*, 8(3): 192-208.

Makgato, M. (2014). The challenges of teaching and learning Technology Subject at schools in South Africa: A case of INSET Teachers in Mpumalanga Province. *Procedia-Social and Behavioural Sciences*, 116: 3688-3692.

Maluleka, K. Wilkinson, A. & Gumbo, M. T. (2006). The relevance of indigenous technology in Curriculum 2005/ RNCS with special reference to the Technology Learning Area. *South African Journal of Education*, 26(4): 501–513.

Mandukwini, N. (2016). Challenges towards curriculum implementation in high schools in Mount Fletcher District, Eastern Cape. Unpublished Dissertation. Pretoria: University of South Africa.

Maniraho, J.F. (2017). The pedagogical content knowledge (PCK) of Rwandan Grade Six Mathematics teachers and its relationship to student learning. *School of Education, College of Humanities*, 1-192.

Mapotse, T.A. & Gumbo, M.T. (2012). Exploring the challenges of senior phase technology teachers in Limpopo province. College of Education, Department of Science and Technology. Pretoria: University of South Africa.

Maphorisa, M.K., Poggenpoel, M. & Myburgh, C.P.H. (2002). Community mental health nurses' experience of decentralised and integrated psychiatric-mental health care services in the Southern mental health region of Botswana. *Curationis*, 25(2): 22- 29.

Mapotse T.A. (2012). The teaching practice of senior phase Technology Education teachers in selected schools in Limpopo province: An Action Research Study. (Unpublished DEd Thesis). Pretoria: University of South Africa.

Mapotse, T.A. & Gumbo, M.T. (2013). Identifying Grades 8 and 9 technology teachers' areas of need for intervention in Limpopo Province. *Journal of Social Science*, 36(1): 19-28.

Mapotse, T.A (2015). Emancipation framework for technology education teachers: an action research study. *International Journal Technology Design Education,* 25: 213-225.

Mapotse, T.A. (2017). Development of Technology Education cascading theory through community engagement site-based support. *International Journal of Technology Designed Education, 28*: 1-16.

Mapotse, T.A. (2018). Development of Technology Education Cascading Theory through Community engagement site-based support. *International Journal of Technology Designed Education,* 28: 685-699.

Maxwell, J.A. (2012). A realistic approach for qualitative research. London: Sage.

McKenney, S. & Visscher, J. (2019). Technology for teacher learning and performance, Technology, Pedagogy and Education, 28(2): 129-132.

McLain, M. (2019). Developing perspectives on 'the demonstration' as a signature pedagogy in design and technology education. *International Journal of Technology and Design,* 31: 3-26.

McMillan, J.H. & Schumacher, S. (2006). Research in education evidence-based inquiry. 6th ed. Boston: MA Allan and Bacon.

McMillan, J.H. & Schumacher, S. (2010). Research in education: Evidence-based inquiry.7th ed. Boston, MA: Pearson Education Inc.

Mestry, J., Hendricks, L. & Bisshoff, T. (2009). Perceptions of teachers on the benefits of teacher development programmes in one province of South Africa. *South African Journal of Education*, 29: 475-490.

Mkandawire, S.B (2010). Impediments to curriculum implementation in learning institutions. *African Higher Education Review,* 8(2): 1-15.

Mohammed, K.K. & Ihsan, A.E. (2016). Applying learning theories and instructional design models for effective instruction. *Advances in Physiology Education,* 40: 147-156.

Moodley, G. (2013). Implementation of the curriculum and assessment policy statements: Changes and implications for teaching and learning. Unpublished Dissertation. Pretoria: University of South Africa.

Moore, C.G., Carter, R.E., Nietert, P.J., & Stewart, P.W. (2011). Recommendations for planning pilot studies in clinical and transational research. *Clinical and Transational Science,* 4(5): 332-337.

Morrison-Love, D. (2017). Towards a transformative epistemology of Technology Education. *Journal of Philosophy of Education*, 51(1): 23-73.

Mouton, J. (1996). Understanding social research. Pretoria: Van Schaik.

Mpungose, C.B. (2020:1). Emergent transition from face to face to online learning in a South African University in the context of the Coronavirus pandemic. *Humanities and Social Sciences Communications,* 1-9.

Mupa, P. & Chinooneka T.I. (2015). Factors contributing to ineffective teaching and learning in primary schools: Why are schools in decadence? *Journal of Education and Practice,* 6(19): 125-132.

Muthusamy, N. (2015). Teachers' experience with overcrowded classrooms in a mainstream school. (Unpublished M. Ed-dissertation). Durban. University of KwaZulu Natal.

National Education Evaluation & Development Unit (NEEDU). 2018. Maximising student learning time and minimising downtime. January, 1-4.

National Department Education (NDE). 1996: National Education Policy Act no 27. Pretoria: Government Printers.

Newsome, J.G. & Lederman, N.G. (1999). Pedagogical Content Knowledge: An Introduction and Orientation. *PCK and Science Education.*

Nokwali, P.M., Mammen, K.J., & Maphosa C. (2014). Assessing educators' views on the implementation of Technology Education in selected schools. *Mediterranean Jounal of Social Sciences,* 5(16): 2039-9340.

Nokwali, M.P., Mammen, K.J. & Maphosa, C. (2015). How is Technology Education implemented in South African schools? Views from Technology Education learners. *International Journal of Education and Sciences,* 8(3): 563-571.

Nordlof, C. Hallstrom, J. & Host G.E. (2019). Self-efficacy or context dependency? Exploring teacher's perceptions and attitudes towards technology education. *International Journal Designed Education,* 29: 123-141.

Nostrom, P. (2014). Technological knowledge and Technology Education. Unpublished thesis. Stockholm: KTH Royal Institute of Technology Architecture and the Environment.

Okello, V. & Kagoiren, M.A. (1996). Curriculum Studies module: Bezatel Design Studies. Kampala: Makerere University.

Olaleye, F.O., Ajayi, A., Oyebola O.B. & Ajayi, O.A. (2017). Impact of overcrowded classroom on academic performance of students in selected public secondary schools in Surelene local government of Lagos state, Nigeria. *International Journal of Higher Education and Research,* 7(1): 110-132.

Ozden, M. (2007). Problems with Science and Technology Education in Turkey. *Eurasia Journal of Mathematics, Sciences & Technology Education,* 3(2): 157-161.

Park, S. & Oliver, J.S. (2008). Revisiting the conceptualisation of pedagogical content knowledge (PCK): PCK as conceptual tool to understand teachers as professionals. *Research Science Education,* 38(3): (261-284).

Park, S. & Oliver, J.S. (2008). Revisiting the conceptualisation of pedagogical content knowledge (PCK): PCK as a Conceptual Tool to Understand Teachers as Professionals. *Research and Science Education,* 38:261–284.

Pirttimaa, M., Husu, J. & Metsarinne, M. (2017). Uncovering procedural knowledge in craft, design, and technology education: A case of hands-on activities in electronics. *International Journal of Technology and Design Education,* 27:215–231.

Polit, D.F. & Beck, C.T. (2008). Nursing research: Generating and assessing evidence for nursing practice. 8th ed. London: Lippincott Williams & Wilkins.

Polit, D.F. & Beck, C.T. (2012). Nursing research: Principles and methods. Philadelphia, PA: Lippincott Williams & Wilkins

Prince, M.J. & Felder R.M. (2006). Inductive Teaching and Learning Methods: Definitions, Comparisons, and Research Bases. *Journal of Engineering Education,* 123-138.

Rakes, G.C., Fields, V.S & Cox, K.E. (2006). The influence of teachers' technology use of instructional practices. *Journal of Research on Technology in Education,* 38(4): 411-426.

Rice, A.H. & Kitchel, T. (2017). Shaping Pedagogical Content Knowledge for Experienced Agriculture Teachers in the Plant Sciences: A Grounded Theory *Journal of Agricultural Education,* 58(4): 50-64.

Robson, C. (2011). Real world research: A resource for social-scientists and practitioner-researchers. 3rd edition. Oxford: Blackwell Publishing.

Rohaan, E. J., Taconis, R. & Jochem, W.M.G. (2010). Reviewing the relations between the teachers' knowledge and pupils' attitude in the field of primary technology. *International Journal of Technology Designed Education,* 20:15-26.

Sedio, M.Z. (2013). Educator's implementation of the intended technology education

Rohaan, E.J., Taconis, R. & Jochems, W.M.G. (2012). Analysing teacher knowledge for Technology Education in primary schools. *International Journal Designed Education,* 22: 271-280.

Romney, A.K., Welter, S.C. & Batchelder, W.H (1986). Culture as concensus: A theory of culture and information accuracy. *American Anthropologist*, 88(2):313-338.

Romylos, S. (2018). Knowledge and identities: the relation between professional identities and PCK (Pedagogical Content Knowledge). Thesis accepted in fulfilment of the requirements for the degree *Doctor of Philosophy in Curriculum Studies* at the North-West University. 1-286

Rule, J. & John, V. (2011). Your guide to case study research, 1st ed. Pretoria: Van Schaik.

Sahin, I. (2011). Development of Survey of Technological Pedagogical and Content Knowledge (TPACK). *The Turkish Online Journal of Educational Technology,* (10)1: 97-105

Samson, A.H. (2013). Learning to change: A study of continuing teacher development in two contexts of educational reform. Unpublished thesis. University of KwaZulu Natal.

Saunders, M., Lewis, P. & Thornhill, A. (2012). Research methods for business students. Cape Town: Pearson.

Snape, P. & Fox-Turnbull, W.H. (2013). Perspectives of authenticity: Implementation in technology education. *International Journal Designed Education,* 23: 51-68.

Strimel, G. & Grubbs M.E. (2016). Positioning Technology and Engineering Education as a key force in Stem Education: *Journal of Technology Education,* 27(2): 21-36.

Selesho, J.M. & Monyane, T. (2012). Analyzing views of Intermediate Phase educators with regard to their experiences of the Revised National Curriculum Statement. *Anthropologist*, 14(2): 107-11.

Sedio, M.Z. (2013). Educator's implementation of the intended technology education in the General Education and Training phase. *International Journal of Science and Technology Education, 5(16)*: 1-146.

Schleicher, A. (2020). The impact of COVID-19 on education-insight from education at a Glance 2020. Retrieved from: https://www. oecd.org>education>impact of Accessed 14 September 2021.

Shabiralyani, G., Hasan, K.S., Hamad, N. & Iqbal, N. (2015). Impact of visual aids in enhancing the learning process case research: District Dera Ghazi Khan. *Journal of Education and Practice*, 6(19): 226-233.

Shirani Bidabadi N, Nasr Isfahani AR, Rouhollahi A, Khalili R. (2016). Effective teaching methods in higher education: requirements and barriers. *Journal of Advances in Medical Education & Professionalism*, 4(4): 170-178.

Simelane, S & Mji, A. (2014). Impact of Technology-Engagement Teaching Strategy with The Aid of Clickers on Student's Learning Style *Procedia - Social and Behavioural Sciences, (136): 511 – 521*

Shulman, L.S. (1986). Those who understand: knowledge growth in teaching. *Educational Researcher*, *15*(4): 4-14.

Shulman, L. S. (1987). Knowledge and Teaching: Foundations of the New Reform. *Harvard Educational Review*, *57*(1), 1-22.

Shulman, L.S. & Shulman, J.H. (2004). How and What Teachers Learn: A Shifting Perspective. *Journal of Curriculum Studies,* 36(2): 257-271.

Silverman, D. (2004). Doing qualitative research. 2nd ed. Thousand Oaks: Sage.

Stoilecu, D. (2014). Studying challenges integrating Technology in secondary Mathematics with Technological Pedagogical and Content Knowledge (TPACK). *International Conferences on Educational Technologies and sustainability, Technology and Education.* Sydney: University of Western Sydney.

Struwig, F.W. & Stead, G.B. (2013). Research: planning, designing and reporting, 2nd ed. Cape Town: Pearson.

Tacoshi, M.M.A. & Fernandez, C. (2014). Knowledge of Assessment: An Important Component in the PCK of Chemistry teachers. *Problems of education in the 21st century*, 62: 124-147.

Teras, M., Suoranta, J., Teras, H. & Curcher, M. (2020). Post Covid-19 education and education "solutionist": *A sellers' market. Post digital Science and Education*, (2): 863-878.

Terre Blanche, M., Durheim, K. & Painters, D. (2006). Research in practice: Applied methods for the social sciences, 2nd ed. Cape Town: University of Cape Town Press. Thompson, S.K. (2012). *Sampling*, (3rd Ed.). London: Wiley.

Tshiredo, L.L. (2013). The impact of the curriculum change in the teaching and learning of science: A case study in under-resourced schools in Vhembe District. Unpublished thesis. Pretoria: University of South Africa.

Tuma, F. (2021:232). The use of educational technology for interactive teaching in lectures. Annals of Medicine and Surgery, (62): 231-235.

Van Aalderen-Smeets, S.I., Walma van der Molen, J.H. & Asma, L.J. (2012). Primary teachers' attitude towards science: A new theoretical framework. *Science Education*, 96(1): 158-182.

Van Driel, J.H. & Berry, A. (2010). *Pedagogical Content Knowledge.* Australia: Monarch University.

Van Wyk, M. & Alexander, G. (2010). Do teaching methods presented by the National Council on economies education (USA) enhance trainers' learning capacity in economics education? A South African Perspective. *Journal of Social Sciences*, 23(3): 159-169.

Welman. C., Kruger, F. & Mitchell, B. (2005). Research methodology, 3rd ed. Southern Africa: Oxford University Press.

West, J. & Meier, C., 2020, 'Overcrowded classrooms – The Achilles heel of South African education? South African Journal of Childhood Education, 10(1): 1-10.

Williams, C. (2011). Research methods. *Journal of Business & Economic Research (JBER)*. 5(3): 15-26.

Wicklein, R.C. (2004). Critical issues and problems in technology education. *The Technology Teacher,* 64(4): 6-9.

Williams, P.J. (2000). Design: The only methodology of technology? *Journal of Technology Education,* 11(2): 48-54.

Williams, J. (2012). Using CoRes to develop the pedagogical content knowledge (PCK) of early-career science and technology teachers. *Journal of Technology Education, 24*(1): 34-53.

Yin, R.K. (2003). Case study research: Design and methods, 3rd ed. Thousand Oaks: Sage.

Zalat M.M, Hamed M.S. & Bolbol S.A. (2021). The experiences, challenges, and acceptance of e-learning as a tool for teaching during the COVID-19 pandemic among university medical staff. PLOS ONE 16(3).

Zwane, S.L. & Malale, M.M. (2018). Investigating barriers teachers face in the implementation of inclusive education in high schools in Gege branch, Swaziland; African Journal of disability. 7(o), 9391.https://doi.org/10.4102/ajod.v7i0.391

APPENDIX – A: Requisition letter to Mpumalanga Department of Basic Education

Enquiries: P.M.A Moeletsi

Contact: 072 877 6597

Private Bag X4021

KwaMhlanga

1022

Mpumalanga Province

08 April 2021

The Head of Department

Mpumalanga Department of Education

Building No.5

1022

Dear: Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT AN EDUCATIONAL RESEARCH

My name is Percinah Maseabe Annah Moeletsi and I am doing research under the supervision of Prof: M.T Gumbo, a senior lecturer in the Department of Curriculum and Instructional Studies towards a Doctoral Degree at the University of South Africa. We have no funding to sponsor this study. We are requesting permission to participate in a study entitled *"Impediments faced by Technology teachers in the teaching of Technology"*. The purpose of this study is to explore the impediments faced by Grades 7 – 9 Technology teachers in Nkangala Sub-District. This case study will consist of twelve Grades 7 – 9 Technology teachers from eight schools. Participants are expected to respond to the face-face semi-structured interview questions, which will be followed by observation. For the purpose of gathering information, a tape recorder and taking notes will be used by the researcher and will be transcribed later.

Participating in this study is voluntary and participants are under no obligation to consent to participation. Participants will be given the consent form to read and sign before participating. They are at liberty to withdraw at any time and without giving a reason. There are no attached promises or benefits for the participants and participation in the study is voluntary. The researcher does not anticipate any harm or negative consequences for the participant in this

study. However, if any unforeseen harm or negative consequences may take place, such, will be reported to the relevant stakeholders such as UNISA Ethics Committee and the Gauteng Department of Education through a written report.

Participants names will not be recorded anywhere, and no one will be able to connect participants to the answers you give. Answers will be given a code number, or a pseudonym and participants will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings. A report of the study may also be submitted for publication, but individual participants will not be identifiable in such a report.

Hard copies of participants' answers will be stored by the researcher for a period of five years in a locked cupboard/filing cabinet at the supervisor office for future research or academic purposes; electronic information will be stored on a password-protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. If necessary, hard copies will be shredded and/or electronic copies will be permanently deleted from the hard drive of the computer through the use of a relevant software programme.

This study has received written approval from the Research Ethics Review Committee of the CEDU research ethics, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish. If you would like to be informed of the final research findings, please contact Percinah Maseabe Annah Moeletsi at 072 877 6597 or email percinah@gmail.com. The findings are accessible for three years. Should you have concerns about the way in which the research has been conducted, you may contact Prof. M.T Gumbo at 082 3258 353 or email: gumbomt@unisa.ac.za.

Hoping that you find this in order.

Yours faithfully

Moeletsi PMA

APPENDIX - B

Academic Research Permission – Mpumalanga Department of Education

education
MPUMALANGA PROVINCE
REPUBUC OF SOUTH AFRICA

Ikhamanga Building, Government Boulevard, Riversi de Park, Mpumalanga Province
Private Bag X11341, Mbombela, 1200.
Tel.: 013 766 5552/5115, Toll Free Line 0800 203 116

Litiko le Temfundvo, Umnyango we Fundo | Departement van Onderwys | Ndzawulo ya Dyondzo

Enquiries : SM Kabini
Tel : 013 947 1745
Email : s.kabini@mpuedu.gov.za

Mrs. PMA Moeletsi
26 Phase 4 Renstown
Hammanskraal
0400
percinah@gmail.com

Dear Sir/Madam

ACADEMIC RESEARCH PERMISSION: PERCINAH MASEABE ANNA MOELETSI, UNISA.

The above matter refers.

The above-mentioned student is studying towards a Doctoral Degree at the University of South Africa (UNISA). **Percinah Maseabe Anna Moeletsi is granted permission to conduct research on her study, titled: "Impediments faces by Technology teachers in the teaching of Teaching Education".**

The student researcher is conducting the study under the academic supervision of Prof. MT Gumbo a Senior Lecturer in the Department of Curriculum and Instructional Studies (UNISA).

Cognisant that the student researcher has successfully completed all research protocols and has been granted ethical clearance by the university, permission is granted for access to and interaction with the schools in Mmametlhake, Nokaneng, Marapyane and Libangeni Circuit as per her request.

We wish the student well in her academic endeavours and encourage that she shares her final research output with the Department as a contribution towards improving teaching and learning.

MR. DM MAJA
DISTRICT DIRECTOR: KANGALA

DATE: 16/1/2017

MPUMALANGA
THE PLACE OF THE RISING SUN

APPENDIX – C: Requisition letter (school principals)

Enquiries: P.M.A Moeletsi

Contact: 072 877 6597

Private Bag X4021

KwaMhlanga

1022

Mpumalanga Province

08 April 2021

The SGB and the Principal

School A Primary School

Mmametlhake

0417

Dear Sir/ Madam

APPLICATION: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

My name is Percinah Maseabe Annah Moeletsi and I am doing research under the supervision of Prof. M.T. Gumbo, a senior lecture in the Department of Curriculum and Instructional Studies towards a Doctoral of Education Degree at the University of South Africa. We have no funding to sponsor this study. We are inviting Grades 8 – 9 Technology teachers "in exploring the impediments in Nkangala Sub-District schools."

The purpose of this study is to explore Grades 8 – 9 Technology teachers regarding impediments they face in Nkangala Sub-District selected schools. This case study will consist of twelve Grades 8 – 9 Technology teachers from eight schools. A total of three Technology teachers are sampled in each of the eight schools. Participants are expected to respond to the face-face semi-structured interview questions, which will be followed by non-participatory observation. For the purpose of gathering information, a tape recorder will be used to record the researcher and participants' conversation, which will later be transcribed.

Participating in this study is voluntary and participants are under no obligation to consent to participation. Participants will be given the consent form to read and sign before participating. They are at liberty to can withdraw at any time and without giving a reason. There are no attached promises or benefits for the participants, therefore, participation is voluntary. The researcher does not anticipate any harm or negative consequences for you as a participant in this study. However, if any unforeseen harm or negative consequences may take place, such, will be reported to the relevant stakeholders such as UNISA Ethics Committee and the circuits through a written report.

Participants names will not be recorded anywhere, and no one will be able to connect participants to the answers you give. Answers will be given a code number, or a pseudonym and participants will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings. A report of the study may also be submitted for publication, but individual participants will not be identifiable in such a report.

Hard copies of participants' answers will be stored by the researcher for a period of five years in a locked cupboard/filing cabinet at the supervisor office for future research or academic purposes; electronic information will be stored on a password-protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. If necessary, hard copies will be shredded and/or electronic copies will be permanently deleted from the hard drive of the computer through the use of a relevant software programme.

This study has received written approval from the Research Ethics Review Committee of the CEDU research ethics, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish. If you would like to be informed of the final research findings, please contact Percinah Maseabe Annah Moeletsi at 0728776597 or email percinah@ggmail.com. The findings are accessible for three years. Should you have concerns about the way in which the research has been conducted, you may contact Prof. M.T Gumbo at 082 3258 353 or email: gumbomt@ unisa.ac.za.

Hoping that you find this in order.

Yours faithfully

Moeletsi PMA

Signature

APPENDIX – D: PARTICIPATION INFORMATION SHEET

***Title*: "Impediments faced by Technology Teachers in the teaching of Technology."**

Dear Prospective Participant

My name is Percinah Maseabe Annah Moeletsi and I am doing research with Prof, M.T Gumbo, a senior lecturer in the Department of Curriculum Studies towards a Doctoral Degree in Curriculum Studies at the University of South Africa. We are inviting you to participate in a study entitled ***"Impediments faced by Technology teachers in the teaching of Technology."***

WHAT IS THE PURPOSE OF THE STUDY?

I am conducting a study:

- To explore the impediments faced by Grades 8 – 9 Technology teachers in Nkangala Sub-District.
- To determine how these impediments affect Technology teachers' practice.
- To propose the strategies through which these impediments can be overcome.

This study is expected to inquire into Grades 8 – 9 Technology teachers' PCK in the Nkangala Sub-District schools of the Mpumalanga Province in order to determine their levels of expertise. This study creates an understanding of the nature of impediments that Grades 7 – 9 Technology teachers face in their practice, and how they actually affect the practice. Understanding the impediments that Technology teachers face in the identified context will help bring improvements that could boost the morale of Technology teachers in the subject. It could also help direct the improvements that might be necessary in the current professional development training for Technology teachers. This study thus contributes new insights towards practice and knowledge concerning the teaching of Technology especially in Nkangala Sub-district.

WHY AM I BEING INVITED TO PARTICIPATE?

You are invited to participate in this study because of your role as a teacher at school with experience in teaching Technology Education in Grades 8 – 9 classes for the previous years. I got your contacts from the District Curriculum Implementation Unit.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

All participants taking part in this study will respond to a semi-structured interview, gather information, and give feedback within seven days after the interview of the participants. Face-to-face interviews for about sixty minutes will be conducted where the researcher would get clarity from the participants so that the correct meaning and information may be analysed.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participation is voluntary and there is no penalty or loss of benefit for withdrawing from participating even when consent to participate was given. If you do decide to take part, you will be given an information sheet to keep and be asked to sign a written consent form. Should you wish to withdraw from the study, you can do so without giving some reasons, however all participants who have already received the structured questionnaires with their names attached maybe required to complete the study as much work would have been done and their data given to the researcher used complete the study, even so it still remains the responsibility of the of the researcher to anonymise all participants' personal data.

WHAT ARE THE POTENTILAL BENEFITS FOR TAKING PART IN THIS STUDY?

The potential benefits of this study will be to share challenges with other teachers and empower each with different approaches and strategies that would assist all participants in dealing with teaching the Grades 8 – 9 learners and improving Technology performance.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THIS RESEARCH PROJECT?

The researcher chose to conduct the study in this area because of its proximity to the place of work and it will be easy to access and not costly, therefore the researcher does not foresee any risk since this study concerns their daily work, however, participants should prepare an inconvenience with regard to sharing more of their personal time to this regard.

ALL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

All the participants have the right to insist that their names not be recorded anywhere and that no one, apart from the researcher and identified members of the research study will know their involvement in this research, however, the researcher assures all of the participants to maintain the confidentiality of all data gathered including their personal details. The participants should, however, note that their valuable input to this research study may be used in a research report, journal article, and conference proceedings.

HOW WILL THE RESEARCHER PROTECT THE SECURITY OF DATA?

Hard copies of your answers will be stored by the researcher in a study room at home for a period of five years in the locked cabinet and this will be saved for future research and academic purposes, electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Reviews and approval if applicable. As a means of destroying data kept, hard copies will be shredded, and electronic copies permanently deleted from the hard drive through the use of the relevant software programme.

WILL I RECEIVE PAYMENT OR ANY INCENTIVE FOR PARTICIPATING IN THIS STUDY?

There shall be no payment or incentive that participants shall receive however the participants are urged to use this exercise as opportunity to their personal development.

HAS THE STUDY RECEIVED ETHICS APPROVAL?

This study has not yet received ethic approval as this is the first application.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact Percinah Maseabe Annah Moeletsi on 072 877 6597 or email her at percinah@gmail.com. Should you require further information or want to contact the researcher about any aspect of this study, please contact Percinah Maseabe Annah Moeletsi here, 072 877 6597 or percinah@gmail.com. Should you have concerns about the way in which the research has been conducted, you may contact Prof. M.T Gumbo on 082 3258 353 or send him an email at gumbomt@unisa.ac.za.

Thank you for taking the time to read this information sheet and for participating in this study.

Percinah Maseabe Annah Moeletsi

APPENDIX – E: Participation Consent Letter

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of my participation.

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and I am prepared to participate in the study

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty. I am aware that the findings of this study will be processed into research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

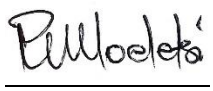
I agree to the recording of the semi-structured questionnaire I am going to respond to. I have received a signed copy of the informed consent agreement.

Participant Name and Surname (please print) _____

_____ _____

Participant Signature Date

Researcher's Name & Surname (please print) Percinah Maseabe Annah Moeletsi



Researcher's signature

APPENDIX –F: Classroom Observation Schedule

Title: "Impediments faced by Technology teachers in the teaching of Technology."

OBSERVATION TOOL COVER PAGE

GENERAL INFORMATION

Name of school	
Topic	
Time	
Classroom/Laboratory Setting	
Size of a classroom/lab	
Number of learners	
The main teaching activity	Comment
The teacher	
Involve learners' activity	
Use appropriate variety of teaching methods and techniques	
Use appropriate teaching resources	
Perform practical demonstrations	
Use assessment to help learners	
Give feedback to learners	

Show good subject knowledge regarding PCK	
The main teaching activity	Comment
The learner	
Think of themselves and ask appropriate questions	
Use discussion to deepen understanding	
Actively performs practical demonstrations	
Participate actively in the entire lesson	
Show understanding of Technology tools	

APPENDIX –G: Semi-Structured Interview

Title: "Impediments faced by Technology teachers in the teaching of Technology."

The interview schedule consists of two (2) sections

1. Please respond to all questions
2. Mark with an X where relevant in section one (1)
3. All information gathered will be kept confidential

Section 1

A: Biographical Information

1. Gender of respondent

M
F

2. Designation of the respondent

Principal
Deputy principal
Head of Department
Teacher

3. Higher Education level

Diploma
Advanced Certificate in Education (ACE)
Degree
Honours Degree
Master's Degree
Doctorates Degree

4. Do you have a Technology related qualification?

YES
NO

Specify your answer.

_____
_____
_____
_____
_____
_____

Section 2

A: Teaching Approaches (Teachers)

1. What are the impediments faced by Grades 8 – 9 Technology teachers in Nkangala Sub-District?

_____
_____
_____
_____
_____
_____

2. How do these impediments affect Technology teachers' practice?

_____
_____
_____
_____
_____
_____

3. What are the strategies through which these impediments can be overcome?

_____

_____

_____

_____

_____

B. Challenges

1. Which challenges do you experience in teaching Technology Education? Please indicate them.

_____

_____

_____

_____

_____

_____

2. Do you have enough resources to teach Technology Education in Grades 8 – 9 classes?

_____

_____

_____

_____

_____

3. What kind of Technology resources does teachers need in your school to enhance effective teaching and learning?

_____

_____

_____

_____

_____

_____

4. Which technology support does the school provide to teachers?

_____

_____

_____

_____

_____

C. Teaching Strategies

1. Which Technology professional developments are needed in your school?

_____

_____

_____

_____

_____

2. Do you have any teaching strategies in place to enhance teaching and learning of Technology?

_____

_____

_____

_____

_____

_____

3. What is the most probable and effective way for teaching and learning of Technology in Grades 8 – 9 classes?

_____

_____

_____

_____

_____

_____

4. What are the critical impediments that will impact on the Technology Education in the near future?

_____

_____

_____

_____

_____

_____

APPENDIX – H: Interview transcripts

Participant 1 School A (P1SA)

Speaker key

IV Interviewer

IE Interviewee

A: Teaching Approaches

IV Thank you for your time, sir. Our interview question consists of eleven questions which are divided into three sub-sections. So, the first question is, how do you experience Technology Education as a teacher?

IE Technology Education is a subject that is new to majority of us as teachers. Teachers and learners need to be technologically literate in order to face the changing world. To be effective in the classroom, I need support and guidance to understand what I am teaching in the classroom such as Technology concepts and assessing learners. Technology needs practical work for learners so that they perform hands-on activities. In our school we don't have any resources for teaching Technology to reinforce what we are teaching in class. Most of the time I improvise for the learning material I want to use in the classroom. It needs qualified teachers to develop interest in learners. Most of the teachers who teach Technology toady have specialised in Mathematics, Physical sciences, Biology and Engineering.

IV Our second question, what are the impediments faced by Grades 8 – 9 teachers in Nkangala Sub-District?

IE As Technology teachers, we do not have any Curriculum Implementer to support us in the whole Nkangala Sub-District. We are only assisted by our Departmental heads in schools who also do not have the curriculum knowledge for teaching Technology Education. We don't attend workshops for curriculum enrichment, so we also don't know whether we are on the right track or not. Only few teachers have the relevant qualifications to teach this subject. For instance, at my workplace we are two teachers who teach Technology Education and I am the

only one who furthered my studies and obtained ACE certificate in Technology Education. The other teacher has diploma in Biology. In Nkangala Sub-District, we are faced with a crises where teachers are redeployed to other schools. The Department of Education only consider the process of LIFO (First-In, First-Out) and forget about the learners' needs. Most of Technology teachers are placed in another schools where you find out that the poor teacher is allocated to teach English or Life Orientation. So, to me Technology is not considered as being important compared to other subjects. Another impediment is that of time allocated for teaching this subject, the time is very limited for learners to grasp everything and to do practical activities. Our learners need to have enough time to do lot of practical work to instil interest in them to learn Technology. To add on that, most of the schools in our Sub-District do not have laboratories and workshops to perform practical work hence the teaching of Technology ends up being teacher centred. We always rash time to complete our ATP's (Annual Teaching Programme) and do talk and chalk while learners are passive in class and end up falling asleep. We also experience shortage of textbooks whereby most of them are dilapidated and teacher are forced to make photocopies to give leaners hand-outs to read during the lesson. My technology classroom is populated due to number of learners who are squashed and prohibits free movement. Due to Covid-19 issues, we are forced to keep social distancing between the learners and it's whereby teaching space is no longer available at all.

IV Thank you, sir, let us continue to the third question. How do these impediments affect Grades 8 – 9 teachers' practice?

IE It is an impediment for Technology tea**c**hers as well as novice teachers to teach without any guidance from the Curriculum Implementer. We really struggle to grasp with the content. Lack of content enrichment causes Technology teachers to struggle with the understanding of the subject matter which leads to be ineffective in their teaching. Lack of knowledge and skills disadvantage teachers to teach learners effectively in the classroom. Teachers do not understand Technology, they are just teaching it for the sake of completing the ATP and no efforts are taken for the benefit of the learners**.** Since Technology Education is a new subject, it needs to be prioritised. Due to these movements of teachers from one school to the next, makes learners to struggle with the understanding of Technology Education because not every teacher can teach this subject, and they are disadvantaged to reach the outcomes. Again, the time allocated to teach Technology is not enough. The time allocated to teach Technology is three periods per week. One period is allocated 30 minutes which is 1H30 minutes per week. Most of the teaching is teacher centred due to the fact that time do not allow us to teach to the

best of our abilities. Shortage of textbooks in schools is also a concern, it disadvantages both learners and teachers because learners can neither do their home-works nor read on their own. For us as teachers we experience a problem because every time during the lesson, we have to replace textbooks by giving learners hand-outs and start from the beginning.

IV Ok sir let's proceed to question four. How do Grades 8 – 9 Technology teachers respond to these impediments?

IE Though we do not have a Curriculum Implementer to support teachers in Technology Education in Nkangala Sub-District, teachers meet as clusters to facilitate Technology. We elected cluster leaders who usually arrange for meetings to assist each other and to make sure that we move at the same pace. Teachers who do not have the speciality to teach Technology are also assisted from the cluster meetings. The other thing is that due to the limited periods and time, I make sure that after the lesson, I give learners projects to do at home. Their projects are not reliable since their parents do the projects on their behalf. They would do better if there was enough time at school for projects and have a workshop where they can perform practical work and know the use of tools. Many of the learners do not perform well because they do not have textbooks to read on their own at home. They only wait for hand-outs during that Technology period which is also an impediment for me to be effective in the classroom. The other thing is that since I experience shortage of textbooks in my school, I always make photocopies for those who are not in possession of textbooks to be on track with others.

B: Curriculum Knowledge

IV Thank you sir. Let's come to the first question under section 2. Which knowledge and skills are appropriate for teaching Technology?

IE Thank you mam. Since I have explained earlier on that I furthered my studies and obtained ACE certificate in Technology Education, I have the knowledge on how to teach Technology concepts and the skill to be used to make learners understand the concept taught. I have the knowledge on how to teach Technology concepts such as processing, structures and system and control. I start by teaching learners on how processing works and up to the end product of it using available materials. When I teach structures such as constructing a bridge, I request learners to collect different materials to show them which materials a stronger than the other to make a bridge. I, therefore, teach them on how to design, make and evaluate the product. The disadvantage part of it is that our learners come from poor families whereby not all materials can be collected for doing other projects. Improvisation is the only way to be used in rural schools during teaching practices to make learner understand the concepts.

IV The second question is, what kind of Technology resources do teachers need in your school to enhance effective teaching and learning?

IE To enhance effective teaching and learning in the classroom, is when the school is equipped with resources such as overhead projectors to make slides to show learners on how material is processed, how different structures are made and how electricity works. According to my knowledge, Technology involves practical where learners can perform hands-on activities. The Department of Education should also build workshops in schools where learners can learn and understand the use of tools and to do their practical work. Video cassette is one of the important resources that could make learning effective in the classroom. Learners need to observe and understand by playing the cassette repeatedly until they are content with what they have been taught.

IV Thank you sir. Let's get to the third question. What kind of support does the schools provide to teachers?

IE To my understanding, no support at all for both new and old Technology teachers in our school. At our school, the Head of Department (HOD) is unqualified to teach Technology hence no curriculum support received from the school. The only support I receive from school is when the HOD visits in the classroom to monitor the progress of my work. Also, when we go for cluster meetings with other Technology teachers in the circuit. The principal then provides us with money for transport.

C: Teaching strategies

IV Thank you sir, we are now at Section C of our interview. The first question is, which Technology professional developments are needed in your school?

IE First of all teachers need to know what Technology is, how does it work and why is it important as a subject. For professional development in my school, I would say that teachers need to develop professionally and understand Technology concepts they are teaching. To understand the concepts, I would also say that teachers need to be trained on how to teach Technology. As teachers we have to understand that Technology is a practical subject that needs teachers who understand it very well. We know that Technology is still a new subject in schools, so most of the teachers are unqualified to teach it effectively. The Department of Education should encourage teachers to enrol with institutions for short causes to have basic

education about Technology. They should have the knowledge on how to use over-head projector and video cassette as teaching resources to make Technology effective. They should be able to give learners pre-cautionary measures on how to work with tools for projects to avoid hurting themselves

IV Anything else sir, you would like to add?

IE No, I think I have basically said everything that I wanted to tell you. However, I can add by saying that when learners get into a workshop, the teacher should understand that learners need to be given prior knowledge on how to work with tools, their names and what are they used for. To teach learners how to behave themselves and how to keep the workshop neat and clean is also very important. Remember as I said previously on that the time allocated to teach Technology is very limited and being developed in using over-head projectors and video cassettes is very important because they save time and limit the use of chalk and talk strategy.

IV Next question. Do you have any teaching strategies in place to enhance teaching and learning of Technology?

IE You know, teaching Technology it's very much challenging. We are not provided with learner teacher support materials (LTSM) to teach Technology and we end up using teacher centred approach in class as well as using talk and chalk method. Sometimes I request learners to collect available resources to use in class since we are not provided with concrete materials to teach them.

IV The last but one question under section C. What is the most probable and effective way for teaching and learning Technology in Grades 8 – 9 classes?

IE The most probable way of teaching that I normally use, is that of excursions. Excursions are the most effective strategy for learners to understand what the teacher is talking about. Since we do not have resources to teach Technology, I request permission from the principal to take learners out for excursions. During excursions learners see different kinds of structures and the materials used. By noticing concrete objects learners will not forget easily. I sometimes take them to a bakery where they will learn the process of making bread up to the end product of it. The disadvantage of it is that learners contribute for themselves to pay for transport for excursions. Learners from disadvantaged families do not have the opportunity to go for excursions. That is one of the reasons why teachers are not effective in the classroom. Our school lack funds to take learners for excursions.

IV Our last question sir. What are the critical impediments that will impact on Technology Education in future?

IE According to my understanding, Technology will have lots of critical impediments in the near future. The major critical impediment that made teachers to develop a negative attitude towards the teaching of Technology is that of lack of resources. The biggest fear is that there will be inadequate graduate requirements in the higher institutions as to who qualifies to teach Technology. Again, there will be a shortage of teachers qualified to teach Technology Education as a subject. As we are nearing the fourth industrial revolution, most of the learners in our country will be disadvantaged to get jobs since they will not be technologically literate the to challenge future.

IV What else can you add to that sir?

IE The other critical impediment in the future is that our country will experience lack of Mechanics and Engineers to produce goods in the industries. Furthermore, teachers will have an inadequate understanding of Technology concepts.

IV Thank you very much, sir, for your time.

Participant 1 School B

Speaker key

IV Interviewer

IE Interviewee

A: Teaching Approaches

IV Right ma'am. Thank you for your time. Our interview consists of eleven questions which are divided into three sub-sections. The first question is, how do you experience Technology Education as a teacher?

IE As a teacher I am thinking that Technology is a good subject to be taught to the learners because it is more or less like sciences. There are some topics that are appearing in Natural Sciences. I think that it is appropriate to teach Technology because they understand it much better as Natural Sciences taught to them but it just that there are some topics that are a bit confusing to the learners that are not there in Natural science subjects. But to me Technology is a good subject for them. You know I wish and I, if I was somebody who is up there, I was going to make sure that it continues in FET as well. Learners were taught Technology in GET and then they should continue with it in FET in Grades 10, 11, and 12 for their careers.

IV Thank you ma'am, lets proceed to question 2.

IE Thank you ma'am.

IV What are the impediments faced by Grades 8 – 9 teachers in Nkangala Sub-District?

IE Thank you ma'am, the main impediments that are faced by us in Nkangala Sub-District is that we do not have a Subject Specialist that used to come to our schools to give us support and to check if we are doing the right thing. In the past, I started teaching Technology in 2014 and I have attended I think is two workshops if not one. There was one in White river in Nelspruit and that is where now my eyes got opened and I was thinking that I would attend some more workshops because I was teaching it in both Grades 7 and 8. So, in most times when I go for workshops, they were only workshopping us about Grade 7 topics and nothing was said about Grade 8. The training sessions were in most cases confusing and rushed for time. The

methodologies were not clearly explained and discussed. The concepts were put on the table, but in many instances the facilitators could not explain the different concepts clearly. So, I was thinking that they will arrange another workshop where they will support us or where they will give us more information about Grade 8 and how to teach it because some of the topics are a bit difficult to us and sometimes you skip the topic without knowing how to teach it which is not fair to the learners. When the exams come learners fail because you did not know how to explain the topic to them. So, I would say in Nkangala Sub-District we need somebody who will move around the schools who will arrange workshops where we are trained how to teach the subject. Right now, we are told that there is this activity that is always accompanying tests and examinations. I am not sure right now that when must I give the learners pad. It was called mini pad in the past. When do I give learners pad as an activity and when must I not give them pad as an activity? When I was looking at the mark sheet that is printed out from the computer from SASAMS. This term it told me that I must, I don't know what I was supposed to do. Meaning that my learners were not supposed to wright a test, they were supposed to make something and from that making I was supposed to break down marks into pieces but instead I give learners a test and a mini pad and I had to take my test marks and my mini pad marks and break it or calculate it so that it fits there in the mark sheet. So, you can really see that we need somebody who can come down and give us advice on how to do everything in Technology. We are teaching it, but we are just following the ATP but some of the items and topics in the ATP are really confusing us. Thank you, ma'am,

IV Ok. Thank you, ma'am. Let's continue to Question three. How do these impediments affect Grades 8 – 9 Technology teacher's practices?

IE Thank you ma'am, they are affecting us so badly because, like I have said, in most times we don't know whether we are doing the right thing or not. You will even see it when the Grade 9's are writing their external examination. You know poor learners will fail the subject because the poor teacher is also confused. So, if you are confused as an educator, what will happen to the poor learners that are depending so much on you? So, I would say it is really affecting us because we sometimes don't know whether we are doing the right thing or not. We are just teaching learners. We are following the ATP and some topics are so difficult to us. So, if the topics is difficult to you as an educator, because you are not qualified to teach it, what will happen to the learners? Due to lack of technology workshops for practical work in schools, teachers just concentrate on textbooks and as the only source of

information hence they are ineffective in their teaching. Technology teachers should first develop knowledge and self-efficacy and the ability to teach the subject before being introduced to Technology concepts so that they do not develop a negative attitude towards the subject. Thank you, ma'am.

IV Let's proceed to question four. I think is the last one from section A. How do Grades 8 – 9 Technology teachers respond to these impediments?
IE Responding, how can I respond on what? What is this? What do we do?

IV Yes, what do you do since you have discovered that you have got impediments or you are experiencing impediments in Technology Education, what are you doing about these impediments?
IE OK, ma'am for now I can say we are just working as a team in our circuit, more especially in the circuit where I am. We call one another and remind one another on what has to be done and then from there we just continue teaching. It's what we are doing. That's what we are doing but eish! really, it's difficult to us. We call one another, we contact one another, and we assist each other. That's how we respond and Ya, but it is still difficult to us. It is still confusing. As Technology teachers we are still confused there and there but with some topics we are fine because I am saying that some of the topics are like those that are in Natural Sciences. So, some topics yes, we really need to assist one another, we keep on reminding one another so that we continue with the teaching.

B: Curriculum Knowledge

IV Thank you ma'am, let's continue to section B which is Curriculum Knowledge. The first question is: Which knowledge and skills are appropriate for teaching Technology?
IE Ok, thank you ma'am. Knowledge and skills, I would say this subject really need somebody who has been trained on how to teach it. Will need somebody who knows how to use the apparatus if they are there in school but if you are somebody who has just being requested to enter the class and teach the learners with an ATP and the textbook, then somewhere you will not do the right thing. Somewhere you will not do justice to the poor learners. So, I would say, I think this thing must be brought down as a skill to educators again like it was done in the past with other educators that told us that they attended some lessons at Turfloop in the past. So, I think it must just be brought down again as a skill so that we know what has to be done in the classroom.

IV Are you done ma'am?
IE We don't have knowledge and skill to teach this subject.

IV Ok, ma'am. Let's continue to the second question. What kind of Technology resources does teachers need in your school to enhance effective teaching and learning?
IE Thank you madam. The resources that are needed in my school for effective teaching and learning, are the apparatus. You know, in Technology we don't just do theory. We teach our learners. Yes, and then but somewhere our learners need to make because we are teaching them on how to make some products in the world. We are preparing them for future. So, we don't have proper materials to show them when we are teaching them on how to make a product. They also do not have proper materials to produce the relevant product that is needed. So, we need apparatus. We need teaching aids. We need proper ones that are relevant to different lessons that we are teaching like electricity we need them. We need resisters, different types of the resister. The LED's, yes, we give them examples because we use to see them, and they use to see them around at their homes or wherever they are but need them so that when we teach them at least we point at something that we are talking about for them to have a better understanding. Thank you, ma'am.

IV Thank you, let's continue to question three. Which Technology support does the school provide to teachers?
IE With me in my school there is nothing. I am the only person who is teaching Technology. Who is also using the little knowledge that I have to support others? So, right now I am not getting any support from any one in our school. Remember we have merged with other school from last year and the teachers here don't know anything about GET subjects. So, to them it's a new something and they don't know how to assist or to support or they don't understand anything about Technology. So, I am not getting any support from the school. Thank you, ma'am.

C: Teaching Strategies
IV Alright ma'am let's continue to section C of our interviews. Question one, which professional developments are needed in your school?
IE Professional development that are needed, we need to be workshopped or we need to attend workshops if they are organised. Workshopping support enough, enough support from a

knowledgeable someone is needed in our school. It's either the person come down to our school and attend to me as an individual person or the person organise workshops, enough workshops for us to know what we are doing because Technology is a new subject. So, we need to be taught, to be trained on how to teach it. Thank you, ma'am.

IV Thank you ma'am. Let's proceed to question two. Do you have any teaching strategies in place to enhance teaching and learning of Technology?
IE The teaching strategies that I have its through making use of text books and then in most time teaching Technology, I make use of text books because I know that in the text books there are pictures that will assist me so that my learners understand what I am talking about easier and better and I am the type of a person who like to give learners practical examples about what they are seeing every time when they walk around i.e taking field trips like when I am teaching them about structures. You know I give them the typical examples that they are seeing every time on their everyday life. Yes, I am using examples and I am using practical examples and I am using textbooks. I do not have charts for teaching my learners. I do not have other pictures. I do not have some other teaching aids or whatever that they can use. Those are the best strategies that I am using when I am teaching my learners, examples, and pictures from the textbook. Thank you, ma'am.

IV Ok, can I make a follow-up from that question?
IE Ok ma'am.

IV Do these textbooks that you are using cover the learners that you are teaching?
IE Yes, for Grade 9 everyone has a textbook and in Grade 8 it's only few that do not have textbooks, very few. For this year they are enough yes.

IV Again do you have any workshop or laboratory where learners can do hands-on activities to make this lesson effective?
IE No ma'am, the Labs that are here in our school are science Labs and in Technology we do not use what we call chemicals. I have never met the topic that wants me to get chemicals and mix them. We only need a Lab where there are relevant tools and relevant materials. Like when we are making structures, we need relevant materials and some other tools that I have mentioned. We have Labs are only for science where there are skeletons, some chemicals like iodine solution and others. Proper Lab for Tech is not there.

IV Thank you ma'am. So, let's continue to the last question but one. What is the most probable and effective way for teaching and learning Technology in Grades 8 – 9 classes?
IE Effective way for teaching these learners I think it's when they are seeing what they are learning about and another way of or good way of teaching this is when they are taught by somebody who has full knowledge of what he/she is talking about. So, without apparatus, without somebody who is not knowledgeable, effective teaching is not taking place. All of us are just reading and talking to the learners. I am better than others, I am able to assist many teachers here. When they need me, they call me because I taught this subject from 2015. So, I have got four years, five years of experience. If I can get more knowledge on how to teach the subject and have more apparatus to teach the learners, I'll be the best person or better. Thank you, ma'am.

IV Thank you ma'am. We have come to the end of our interview**.** The last question is, what are the critical impediments that will impact on the Technology Education in the near future?
IE Critical impediments that I am thinking of here will be the matter of not having good teachers to teach these learners. Learners end up losing interest because they are not sure of what they are talking about. The products that they are making are not real. So, I am always giving them examples of the soapy that I use to watch at home around half past six on SABC 1 and that one of Skeem Saam. I give them example about Thabo Maputla and Zamokuhle that those guys are Technologists they have studied Technology in high school and tertiary. That is why they were able to make something very important and they got money from that. So, you listen to me that is the motivation that I am always giving to my learners. If you are listening to what we are talking about and continue with Technology in future then you will be like Zamokuhle and Thabo Maputla. So, what I am seeing right now is that we don't have apparatus, we don't have knowledgeable teachers. Our learners will lose focus and interest in Technology and where will we get Technologists in future. We will end up inviting people from outside our country to come down and work here or to come down and do the job on our behalf which is something that is not acceptable. Thank you, ma'am.

IV Thank you ma'am, we have come to the end of our interviews. I would like to thank you very much for your time.