

**CHALLENGES FACED BY GRADE NINE TECHNOLOGY TEACHERS IN
THEIR ABILITY TO FACILITATE MINI-PRACTICAL ASSESSMENT TASKS
AT PALALA CIRCUIT SCHOOLS, LIMPOPO PROVINCE.**

MASTERS DEGREE IN TECHNOLOGY EDUCATION

By

H.K RAMABOEA

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by

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DISSERTATION

Submitted in fulfilment of the requirements for the degree of

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ABSTRACT

This study used a case study to explore the challenges faced by Grade 9 Technology teachers when facilitating mini-Practical Assessment Tasks (PAT) in the classroom. The 9E instructional model played an important role to understand the challenges faced by the Grade 9 Technology teachers when facilitating the design process and it assisted in showcasing how the Grade 9 Technology teachers facilitate the Mini-PAT in the technology classroom. The constructivist approach was used as the lens of the study. The study proposed the use of the 9E instructional model to understand the teachers' constructivist teaching system in each activity during the Technology design process Investigation, Design, Making, Evaluation and Communication (IDMEC).

The study employed a qualitative research approach to gather non-numerical data. Hence, the study used an exploratory case study to explore how the Technology teachers facilitate the design process in the Technology classroom. A total of ten Technology teachers who were teaching the Technology subject were purposively sampled and interviewed while four participants were selected for observations. Data was collected using semi-structured interviews and non-participants' observation. The interview tape-recorded data was manually transcribed into word form. The data was textually analysed and displayed as verbatim quotes from the interviews. The researcher used field notes to capture the activities that were unfolding in the classroom. Observation schedules were also developed to elicit the important information that was used to answer the research question.

The findings of the study revealed that most of the teachers experienced challenges when engaging with the learners, as well as in the provision of materials and equipment, using topic-specific strategies, relating the content with the learners' real-life experience, and connecting the learners' everyday experience with the content. They also had difficulties in providing clear explanations that limit misconception, and could not summarise the concepts, and use the learners' ideas to identify and correct misconception when facilitating the mini-practical assessment tasks in the classroom.

The study further found that most of the teachers who struggled to teach Technology education actually lacked a science or engineering background.

The study recommends that the teachers should be provided with adequate resources that enable them to utilise their critical thinking skills when teaching the design process. The teachers should be well trained in practical skills, and they must be afforded the opportunity to practice real-life situations that are similar to what the learners experience in the classroom. In addition, the teachers should be familiarised on how to facilitate the mini-PAT through the design process. The teachers should be developed on how to engage with learners on activities, and on how to make material and equipment accessible to learners during activities. The teachers also have to be trained on how to use topic-specific strategies to relate the content with the learners' real-life experience and on how to connect the learners' everyday experience with the content and on how to provide clear explanations that limit misconceptions. Most importantly, the teachers should be prioritised based on their expertise in teaching Technology education.

Key words: Explore challenges, facilitating mini-practical assessment task, 9E instructional model, design process, resources, practical skills.

DECLARATION

I declare that the dissertation hereby submitted to the University of Limpopo, for the degree of Master's Degree in Technology Education has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

RAMABOEA H.K (Mr)

13/10/2022

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To all my study mates, you made the process significant. To all the participants, you made this study a success. Thank you to all the principals of the participating schools in this study, without your permission I would not have made it this far.

DEDICATION

I dedicate this study to my late parents Johannes Masipa Ramaboea and Elsie Dikeledi Monageng Ramaboea who always wanted to see the best in me and always supported and motivated me to continue with my education. Most importantly for teaching me the importance of prayer which is the best gift I have ever had.

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ACRONYMS

Mini-PAT:	Mini-Practical Assessment Task
CAPS:	Curriculum Assessment Policy Statement
GET:	General Education and Training
DBE:	Department of Basic Education
DoB:	Department of Education
DP:	Design Process
OBE:	Outcomes Based Education
NCS:	National Curriculum Statement
IDMEC:	Investigation, Design, Making, Evaluation and Communication

CHAPTER 1: BACKGROUND AND MOTIVATION

1.1 Introduction and motivation

The Mini-Practical Assessment Task (Mini-PAT) is a set of assessment tasks that is designed for different activities with the aim of developing the learners' critical thinking skills. The core of these activities is to develop the learners' real-life problem-solving skills (De Jager, 2011). Within the context of reforming the Curriculum Assessment Policy Statement (CAPS) for Technology education in General Education and Training (GET), several attempts have been made to improve the way in which practical assessment tasks are carried out (Department of Basic Education (DBE), 2011). The latest improvement of policy on teaching and learning involves the effective implementation of the curriculum (Mbongwe, 2016). The improvements place several obligations on Technology teachers to facilitate Mini-PAT and to develop technological problem cases that will enable the learners to manufacture a corresponding product design or artefact (Rauscher, 2016). According to Mbongwe (2016), this approach has placed challenges on Technology teachers to identify and develop tasks since they are not able to monitor and assist learners as they go through the design process. Although many issues were improved, one of the challenges with the Mini-PAT for Technology teachers is the lack of content knowledge to assist in improving the practical skills of teaching and learning (Kubheka, 2018). Schwichow, Zimmerman, Croker and Härtig (2016) argue that most Technology teachers have a challenge of measuring the learners' skills that are acquired in the design process when facilitating the Mini-PAT. Based on this, this study sought to explore the Grade 9 Technology teachers' ability to facilitate Mini-PAT.

According to Pellegrino, DiBello and Goldman (2016), assessments need to be guided by models in classroom practice. Although the teachers were trained to do assessments on the design process, they still have challenges to assess the new Mini-PAT. During the designing process, the learners can follow systematic processes to guide their designing skills (Haik, Sivaloganathan & Shahin, 2018). Since the learners follow a systematic design process, the teachers can come up with their assessment guides based on the processes. At the same time, this can be done by providing the teachers with correct hands-on practical skills to improve their classroom instruction

(Kubheka, 2018). According to Schwichow et al. (2016), the teacher's knowledge and skills are important during the facilitation of the design process. However, most literature including that by Sephoto and Kola (2018) as well as Rauscher (2016) found that Technology teachers do not have enough knowledge and skills to facilitate the designing and making of artefacts. In addition, Isa and Andre (2014) also found that Technology teachers find it difficult to assist learners in planning their design process. According to Gómez, van Eijck and Jochems (2013), the Technology teachers need lecture-by-demand or benchmark lessons to expose their best practices to facilitate the design process. Hence this study sought to explore the Technology teachers' facilitation of the Mini-PATs in the classroom.

Although there are several studies that were conducted on "hands-on practical tasks" in various countries such as Germany (Schwichow et al., 2016); Netherland (Isa & Andre, 2014); Malaysia (Mohamad, Khaidzir & Ibrahim, 2015) and in Turkey (Hırça, 2017), not much focus has been put on assessment issues. Based on this gap, this study sought to contribute to this knowledge gap by identifying the assessment challenges that are faced by Technology teachers and suggestions on ways to alleviate them will be discussed.

1.2 Research problem

The design process forms the backbone of teaching Technology to engage learners in systematic process aiming to develop solutions to problems, and it should be used to structure the delivery of all the learning outcomes. The technological design process involves the integrated process of making a product or prototype. However, during various DBE training and workshops, most teachers have raised the issues of not having formal training in the Technology subjects and they find it difficult to facilitate the design process skills. They alluded that they do not have the ability to facilitate the Mini-PAT in Technology and transfer the knowledge to the learners. The teachers are having a difficulty in doing hands-on practical activities due to the lack of adequate technical skills and pedagogic content knowledge. Their comments raise questions since Technology teachers are expected to facilitate the Mini-PAT for each Technology concept. Therefore, if the teachers do not have thorough skills to facilitate the Mini-PAT, they will not be able to facilitate the Technology content knowledge. This is a problem since the teachers will eventually focus more on the theory section than

the practical section. As indicated before, the Technology subject is a practical based subject that requires the learners to apply hands-on skills. If the teachers do not provide practical lessons, the learners will not have adequate skills in Mini-Practical Assessment Tasks. Hence this gap motivated the researcher to understand the Technology teachers' ability to facilitate the design process skills. The study give emphasis on how grade nine (9) Technology teachers facilitate Mini-Practical Assessment Task in their classrooms. The results of the study can be used as an information to develop teachers in facilitating practical assessment tasks within the context of reforming Curriculum Assessment Policy Statement (CAPS) for Technology education in General Education and Training (GET). Information collected will help in coming up with strategies for Technology teachers to facilitate Mini-PAT. Therefore, the analysed results of this study serve as a secondary source to the identified gap and provide solutions that a new generation of research in this area needs to address.

The research and information containing teachers' ability to facilitate Mini-PAT in Technology is not widely researched. Guide on facilitating Mini-PAT or artefact have been lacking in Technology education and little has been done on how facilitation on artefacts has been done.

The study will give emphasis on how grade nine (9) Technology teachers facilitate Mini-Practical Assessment Task in their classrooms. The results of the study can be used as an information to develop teachers in facilitating practical tasks within the context of reforming Curriculum Assessment Policy Statement (CAPS) for Technology education in General Education and Training (GET). Information collected will help in coming up with strategies for Technology teachers to facilitate Mini-PAT. Therefore, the analysed results of this study will serve as a secondary source to the identified gap and provide solutions that a new generation of research in this area needs to address.

1.3 Preliminary literature

1.3.1 *Mini-PAT in technology education subject*

Technology education was introduced in 1998 as a separate learning area in a new curriculum (DoE, 1997). The introduction of the new curriculum called Outcomes Based Education (OBE) in 1998, was to replace the post-apartheid education system that was established during the apartheid era (Jansen, 1998). However, it was accompanied by the serious challenges that were identified which led to its revision

and the introduction of the National Curriculum Statement (NCS) in 2002 (Makgato & Ramaligela, 2012). However, the revised NCS initiated other challenges and it was also revised to a new curriculum called Curriculum Assessment Policy Statement (CAPS) (Badugela, 2012). The challenges included but are not limited to inadequate resources, financial constraints, and the lack of training (Badugela, 2012).

However, the NCS is a policy, while the new National Curriculum and the CAPS give clear guidelines on the implementation of the NCS (De Jager, 2011). The reconstruction of NCS was used to strengthen and provide clear guidelines on how the Technology teachers must facilitate Mini-PAT. In NCS, the term continuous assessment task which involves informal and formal assessment is used. The new NCS was improved, and it was referred to as the CAPS. The CAPS has been structured in such a way that the Investigation, Design, Making, Evaluation and Communication stage (IDMEC) is a backbone or a methodology of teaching four content knowledge areas (DBE, 2011). The teaching of technology subjects is structured through the design process as a backbone or a methodological part to facilitate the entire process (De Jager & DBE, 2011). The design process in technology is a series of steps that technology teachers facilitate to the learners as they solve problems [Department of Basic Education (DBE), 2011]. The design process includes IDMEC (DBE, 2011).

The technology subject has four content knowledge areas, that is structures, processing, mechanical systems, and control as well as electrical system and control. The teaching of these content areas requires a knowledgeable teacher who knows how to make the product which includes the knowledge of investigation, design, making of product, evaluation of the product, and communicating the product. According to Kubheka (2018), this is the specialized knowledge that the technology teachers need before designing any product. However, according to Rauscher (2016), most of the teachers in South Africa were not trained to teach Technology but they were transferred from the science of home economics subject to teach this new subject. Based on the two arguments, this study sought to understand the challenges that are faced by the Technology education teachers to facilitate the subject.

1.3.2 Facilitating hands-on practical tasks

The hands-on practical tasks in the technology subjects refer to the practical activities

that result in tangible outcomes such as a model, an artefact, or an ornament (Kubheka, 2018). Recently, there were several teacher development programmes that were conducted by the DBE in South Africa to familiarise the teachers with hands-on practical tasks (Hırça, 2017). However, the teachers still find it difficult to teach practical tasks (ibid). Also, Kubheka (2018) outlines that the lack of educational resources, the inadequate training of the Technology teachers and even the overcrowded classes are some of the challenges that hinder the teaching of Mini-PAT.

Furthermore, Gumbo (2020) highlights that the Technology teachers have limited pedagogic knowledge and skills in teaching the technology design process. Schwichow et al. (2016) also indicate that the teachers have a difficulty in doing hands-on practical activities due to the lack of resources among other things. However, Rauscher (2016) asserts that the Technology teachers are still lacking the necessary content knowledge and skills to facilitate the Technology subject. Based on the above, this study sought to explore the challenges that the Technology teachers experience when they are facilitating Mini-PAT. Although, Kubheka (2018) highlights that team teaching helps to address the challenges in the teaching of the Mini-PAT, Rauscher (2016:11) indicates that “Technology teachers in South African Schools seem to have poor grasp of the complexity of this important part of knowledge that is specific to Technology”. The literature by Hırça (2017) has focused on the Science and Technology teachers’ experiences on conducting hands on practical tasks. According to Hırça (2017), the most experienced teachers have a difficulty in doing hands-on practical tasks and prefer not to do the practical. Makgato and Khoza (2016) concluded that the technology teacher education should empower both in-service and beginner teachers when they are engaging in practical tasks.

1.4 Theoretical framework

To explore how the Grade 9 Technology teachers facilitate the Mini-PATs in the classroom, this study used Amineh and Asl’s (2015) theory of constructive teaching and adopted the 9E Instructional model (Ramaligela, Ogbonnaya & Mji, 2019). Amineh and Asl (2015) view the theory of constructive teaching as a personal construct system where the teacher needs to create situations that challenge the assumptions of traditional teaching to constructive teaching. According to Shah (2019), constructivist teaching is based on the constructivist learning theory where the learning occurs as

the learners are actively involved in a process of meaning and knowledge. According to Amineh and Asl (2015), to teach constructively, the teacher must engage the learners in learning, guiding, and considering the learners' prior knowledge. Shah (2019) further explains that the constructivist teacher as a facilitator must consider the learners' needs and they must encourage peer interaction. Amineh and Asl (2015) indicate that the teacher should create situations in which the students will question their own and each other's assumptions and build new knowledge through exploring and reflecting to form new ideas. This theory is relevant to this study since the Technology subject requires engaging in each assessment task in a constructive approach where the learners are required to explore, question their assumption, and reflect on various issues to build new knowledge. Hence, this study sought to explore how the teachers facilitate Mini-PAT in their classroom through the lens of a constructive system.

Although the constructivism theory may be more relevant as a lens in this study, it does not fully allow the researcher to understand how each activity is facilitated in a constructive manner. To understand the teachers' constructivism teaching system in each activity, the study proposes the 9E instructional model. According to Ramaligela et al. (2019), the 9E instructional model is a measure to evaluate the classroom instructional activities. Hence, this study will use the 9E instructional model to understand how the technology teachers facilitate the design process skills in a constructive manner. As indicated by Ramaligela et al., (2019), the phases of the 9E instructional model are compatible with the IDMEC technology design process. The phases that will be adapted from the 9E instructional model are, Elicit, Engagement, Exploration, Enlightening, Elaboration, Evaluation, Explanation, Enclosure and Exchange because the phases remain relevant to the IDMEC technology design process.

1.5 Research questions

The purpose of this study is to explore the challenges faced by the Grade 9 Technology teachers when they are facilitating the Mini-PATs in the classroom. To understand these challenges, this study was guided by the following research questions:

1.5.1 Research questions

RQ1: What are the challenges faced by the Grade 9 Technology teachers when facilitating the design process?

RQ2: How do the Grade 9 Technology teachers facilitate the Mini-PATs in the technology classroom?

1.6 Research methodology

1.6.1 Research approach

This study employed the qualitative research approach. Qualitative research is a method of gathering non-numerical data, while focusing on meaning-making and on human elements (Denzin & Lincoln, 2005). According to Stake (2010), qualitative research focuses on generating descriptions and situational interpretations. This qualitative study is positioned on Stake's (1995) perspective of case study design. The author defined a qualitative case study as a study that seeks a greater understanding of a case. Stake's (2010) qualitative case study was suitable for this study since the study sought to explore the multiple cases on how the Technology teachers facilitate the design process in the Technology classroom. In addition, according to Stake (2008), a case study is developed to study the experience of real cases in real situations and the case is the member of the phenomenon. Hence, this study used an exploratory case study to explore how the Technology teachers facilitate the design process in the Technology classroom.

1.6.2 Population and Sampling

1.6.2.1 Population

The population refers to the total number of Grade 9 Technology teachers in the Waterberg District where the sample was chosen from (Carol & Iben, 2014). The Waterberg District has 149 schools and 15 circuits. Palala is one of the circuits and it has 23 high schools.

1.6.2.2 Sampling

This study used purposive sampling because it allowed the researcher to select the participants based on the specific purpose of aiming to address the research questions

or the study purpose (Creswell, 2018; Carol & Iben, 2014). This study selected ten Technology teachers. The ten teachers participated in the interviews and, four participants were further selected for observations. The four teachers who were chosen for observation were also purposively sampled since the researcher wanted to observe two teachers who indicated that they were challenged when facilitating the Mini-PAT and two teachers who indicated that they had limited Challenges. The sampling of the participants who were observed was done after the interview analysis.

1.6.3 Data collection techniques

Data was collected using semi-structured interviews and non-participants' observations. This study used the sequential data collection method (Stake, 1995), where the researcher conducted the interviews and then did classroom observations. The interview data informed the observations since the researcher observed the teachers who were experiencing challenges as well as those who were knowledgeable about facilitating the Mini-PAT.

1.6.3.1 Semi-structured interviews

This study used semi-structured interviews to understand the challenges that the Technology teachers faced when facilitating the Mini-PAT. The semi-structured interviews refer to finding out the participants' opinion regarding the research questions (McIntosh & Morse, 2015). This study used semi-structured interviews because they enable reciprocity between the interviewer and the participant and the interviewer is able to make follow-up questions based on the responses of the participant (Kallio, Pietilä, Johnson, and Kangasniemi, 2016). Interview schedules were used where a set of semi-structured questions was drawn to understand the challenges that the Technology teachers experience when facilitating the Mini-PAT. The interviewing technique was used to gain in-depth data from the ten participants. The questions included the participants' biographical data, gender, age, education level, teaching experience in teaching Technology and information about classroom experience.

1.6.3.2 Non-participant observation

This study used non-participant observations because the researcher was not involved in the teaching (Ciesielska, Boström & Öhlander, 2018). The non-participant

observation method was used to explore how the Technology teachers facilitate the Mini-PAT in their classroom because the observation enabled the researcher to gather enough information in a wide range of phenomena (Ciesielska et al., 2018). The researcher used field notes to capture the activities that were unfolding in the classroom, since videos or visuals are prohibited in most schools. Furthermore, the observation schedules were developed to elicit important information that was used to answer the research question. As indicated earlier, the study used the 9E instructional model as a conceptual framework to develop the observation schedule.

1.6.4 Data analysis

The purpose of analysing qualitative data was to determine the relationships and the assumptions that inform the respondents' view and the topic in relation to the research questions (Noble & Smith, 2014).

1.6.4.1 Analysis of semi-structured interviews

The interview tape-recorded data was manually transcribed into word form. The data was textually analysed and displayed as verbatim quotes from the interviews. The verbatim quotes were suitable for the study because they are commonly used in educational research as they provide descriptive data (Carol & Iben, 2014). The interview transcripts were coded by reading through the data, categorizing the data into codes and interpretation by using memos for clarification (Stucky, 2015). The coding helped to compile the descriptive information during the study. The categories were drawn from the 9E conceptual framework because the researcher started to detect patterns in the data and to develop conclusions.

1.6.4.2 Analyses of non-participant observations

The video recorded data was manually transcribed into word form by answering the observation schedule. The video data was manually transcribed into narrative story text form, quoting the exact statements that were provided by the participants during their classroom practice to provide a detailed description of the information (Creswell, 2018). If the field notes were used, they were analysed and coded into themes and categories according to the 9E instructional model. The themes and categories from the field notes were used to understand the teachers' mode of facilitating the Mini-PATs and to present data.

1.7 Significance of the study

This study identified the challenges faced by the Grade 9 Technology teachers when facilitating the Mini-PATs in their classrooms. This is an area that has not been fully investigated in the South African education system. The results of the study can be used as a basis to develop the teachers in facilitating practical tasks within the context of reforming the CAPS for technology education in General Education and Training (GET). The collected information will help in coming up with the strategies for the Technology teachers to facilitate the Mini-PATs. Therefore, the analysed results of this study serve as a secondary source to the identified gap, and they provide the solutions that a new generation of research in this area needs to address.

1.8 Ethical considerations

1.8.1 *Permission to carry out the research*

Ethical clearance was sought from the Turfloop Research Ethics Committee [TREC] in accordance with the acceptable ethical procedures. Permission was then requested from the Limpopo DBE, Waterberg District (Palala circuit).

1.8.2 *Informed consent*

Informed consent can be defined as a procedure in which the participants in a study are given important details about the study including the risks and the benefits before, they can choose whether to participate in a study or not (Nnebue, 2010). All the Grade 9 Technology teachers were made aware of what the informed consent form is, and they were asked to fill in the consent form that was obtainable from the University of Limpopo's postgraduate guide. The participants were informed that they can withdraw from the study at any time. The researcher ensured that the participants were fully aware of the rationale of the study and that they understood the importance of the study (Connelly, 2014). The informed consent form from the University of Limpopo was issued to each participant.

1.8.3 *Voluntarily participation*

No participants were coerced to take part in the study (Babbie, 2016). The participants were allowed to consent and later withdraw if they want to, and no questions were asked. The participants needed to understand their role and the nature of the study so that they may be fully aware of what the study entails. The researcher did not lie or

deceive the participants (Babbie, 2016).

1.8.4 Confidentiality and anonymity

All the collected data was confidential, and the participants' names were presented in the study using pseudonyms (Connelly, 2014). The data in the study was only used for the purpose of the study, and no subject identity was linked with personal responses (Babbie, 2016). All the field notes that were taken during the observations will be safe guarded at the university for a period of five years and will only be accessed by the researcher and the supervisor(s).

1.9 Chapter division

CHAPTER 1: BACKGROUND AND MOTIVATION OF THE STUDY

This chapter provides a clear description of the mini- practical assessment tasks. This chapter also provides the information on the improvements that have been made on the technology teachers to facilitate Mini-PAT and to develop the technological problem cases that will enable the learners to manufacture a product. The chapter further provides the information on the challenges faced by the technology teachers when facilitating Mini-PAT, a clear overview of the problem statement, preliminary literature, role of theory that was used as the lens of the study and the model that was used to measure the instructional activities. It also includes the purpose of the study, the research questions that were used to understand the challenges faced by the technology teachers when facilitating the Mini-PAT, the methodology, the significance of the study and the aspects of ethical consideration.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This chapter provides information on the introduction of the Mini-PAT in the new curriculum, and it highlights the importance of the core activities within the context of the CAPS for Technology education. This chapter also focuses on the improvements that have been made on the way the practical assessment tasks are to be carried out. It gives an overview of the relationship between the NCS and the CAPS.

This chapter further outlines the challenges that the technology teachers experience in facilitating the Mini-PAT.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter provides information on the approach, and it outlines the perspective on which the approach is positioned in this study. This chapter also gives information on the research design and how the population and sampling was done. This chapter also gives information on how data was collected (two methods of collecting data). The chapter also gives an outline of the conceptual framework of the study that was used to guide and to develop the observable schedule. The chapter further describes how data was analysed. There is also information on how the trustworthiness of the study was maintained through the interpretivist perspective by considering the trustworthiness of the instruments of the study.

CHAPTER 4: RESULTS AND DISCUSSION

This chapter provides the information that was gathered in the study, and it presents the data and the findings of the study.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

This chapter provides information on the conclusion based on the findings and it makes relevant recommendations based on the findings.

1.10 Summary of the chapter

This chapter discussed the introduction, the background of the study; the problem statement; the preliminary literature; the snapshot of theoretical framework; the research purpose and questions; the snapshot of the research methodology; and the ethical consideration. The next chapter will provide a detailed analysis of the literature review and the theoretical framework that was used in this study.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter discusses a detailed analysis of the literature, and it focuses on the introduction of the Mini-PATs in the Technology subject. The literature discusses how technology is structured to facilitate the four content areas of mechanical systems and control, structures, electrical systems, and Control, as well as processing using the IDMEC as the backbone to implement classroom activities. The focus is on the challenges that are faced by the Technology teachers and how they facilitate the Mini-PAT. Moreover, this chapter discusses the theoretical framework in relation to its compatible 9E instructional model. Hence, this chapter focuses on the overview of the technological processes and the attained skills in relation to the assigned instructional model.

2.2 Mini-Pat in the technology subject

Technology education was introduced in 1998 as a separate learning area in a new curriculum (DoE, 1997). The introduction of the new curriculum called Outcomes Based Education (OBE) in 1998, was initiated to replace a different curriculum that was established during the apartheid era (Jansen, 1998). However, it was accompanied by serious challenges that led to its revision and the introduction of the NCS in 2002 (Makgato & Ramaligela, 2012). The introduction of the revised curriculum initiated other challenges and it was also revised to a new curriculum called CAPS (Badugela, 2012). Those challenges include but are not limited to inadequate resources, financial constraints, and the lack of training (Badugela, 2012).

The NCS remains as policy, while the new CAPS gives clear guidelines for the implementation of the NCS (De Jager, 2011). The reconstruction of NCS was used to strengthen and provide clear guidelines on how Technology teachers must facilitate Mini-PATs. In NCS the term continuous assessment task involves informal and formal assessments. The new curriculum document was improved, and it was referred to as CAPS. The CAPS has been structured in such a way that the IDMEC is a backbone or the methodology of teaching the four-content knowledge (DBE, 2011).

The teaching of technology is structured through the design process to facilitate the entire process, as the teachers facilitate the process (De Jager & DBE, 2011). The design process in technology is a series of steps that the technology teachers facilitate to learners as they solve problems (DBE, 2011). It includes IDMEC (DBE, 2011).

The Technology subject has four content knowledge aspects, that is, structures, processing, mechanical systems, and control as well as electrical system and control. The teaching of the content areas requires a teacher to possess the (1) Knowledge of the subject matter, (2) Knowledge of making products which includes knowledge of investigation, design, making of product, evaluation of the product, and communicating the product. According to Kubheka (2018), this is a specialised knowledge that the teachers need to have before designing any product. According to Rauscher (2016), most of the teachers in South Africa were not trained to teach Technology but were transferred from other learning areas to teach this new subject. Based on the two arguments, this study sought to understand how the Technology education teachers facilitate this subject.

Since the introduction of Technology in the new curriculum framework based on the outcomes-based education, many teachers find it difficult to apply alternative ways to enhance teaching in classrooms (Janak, 2019). Janak (2019) argues that the teachers are resistant to the use of technology resources due to the lack of technology skills and knowledge. In contrast Nkosi and Adebayo (2021) find that the teaching and learning were mainly constrained by the non-availability or the limited learning and teaching materials. However, the findings of the study conducted by Chiliba (2019) indicate that the Grade 9 Technology teachers promote critical thinking skills in their teaching of the design process. According to (Makhubele, Simelane-Mnisi and Makgato (2019), it is important that the technology learners are provided with practical skills by applying the design process. In active learning, the teachers are afforded opportunities to practice real-life situations that are similar to what the learners will experience in the classroom (Hinton, 2020).

Mtshali (2020) states that the Mini-PAT should not ignore these aspects of critical thinking. Makhubele et.al. (2019) further argue that the teachers have a limited

understanding of critical thinking. In addition, the authors find that the lack of resources hinders the critical thinking skills when teaching the design process and the teachers

only use textbooks to facilitate and set activities. Hence, the study conducted by Mtshali, Ramaligela and Makgato (2020) shows that most teachers use textbooks and previous exam question papers to teach their lessons.

In the constructivist approach, the teacher emphasises that the learners must retain and apply knowledge to a larger lifelike context that stimulates the learners to reflect, organise, analyse, and solve problems (Ankiewicz, 2021). Groves (2021) asserts that the teachers' continuing use of the transmission style pedagogy does not use the technological material in the classroom as compared to the teachers with constructivist pedagogy techniques. According to Ankiewicz (2021), the teachers are expected to implement technology education without adequate pedagogical training. Hence, the teachers have to be equipped with the necessary skills and knowledge to teach technology education (Ankiewicz, 2021). The study conducted by Ankiewicz (2021) shows that the teachers were not sure how to facilitate the teaching Technology in the classroom. Ankiewicz (2021) says the lack of appropriate resources (classrooms, workshops, tools, equipment, materials) becomes a challenge on how to facilitate the Technology classroom. In contrast Isaac and Manto (2019) highlight how the availability of resources for practical skills does not assure the effectiveness of the skills gained in the Technology classroom.

According to Ankiewicz (2021), Technology education was introduced as a successor to various forms of craft or technical education, and it has held challenges for the teachers who were responsible for the implementation of technology. However, Janak (2019) says that not all the Technology teachers adopt a student-centred approach to teaching Technology. Kola, Rauscher and Haupt (2019) state that the technology teachers have a challenge of translating and employing critical thinking skills in the Technology classroom. Kola et al. (2019) further highlights that teaching technology in the classroom is restricted. Ankiewicz (2021) argues that Technology is a technical subject, and it requires the teachers to be well trained in different technology themes and in different material. Hence, the lack of teachers' confidence, the incompatible pedagogical approaches and the restrictive curricula are also challenges to most technology teachers (Gumbo, 2019). The study conducted by Kola (2021) on the pre-service teachers' action research indicates that both pre-service and established teachers experience difficulties when developing learning activities in Technology

Education. However, the study conducted by Janak (2019) on the Technology teachers' perspectives on the technology curriculum brings a wider perspective of the challenges that the technology teachers have to execute in the Technology classes.

2.3 Challenges faced by technology teachers when facilitating mini-PAT

The hands-on practical tasks in the Technology subject refer to the practical activities that result in tangible outcomes such as the model, an artifact, or an ornament (Khubheka, 2018). Recently, there are many teacher development programmes that were conducted by DBE in South Africa to familiarise the teachers with hands on practical tasks (Hirca, 2017). However, the teachers still find it difficult to teach practical tasks. Also, Kubheka (2018) outlines that the lack of educational resources, the inadequate training of Technology teachers and even the overcrowded classes are some of the challenges that hinder the teaching of mini-PAT. Gumbo (2020) further highlights that Technology teachers have limited pedagogic knowledge and skills in teaching the technology design process. Nkosi (2020) observed that during the lesson observations, the teachers were able to provide the learners with the Mini-PAT as required by the CAPS, but all the teachers were not familiar with certain stipulations of the subject policy. Kola (2021) supports that it is important that Technology teachers understand the content to be taught. The author further indicates that planning helps the teachers to set appropriate tasks and provide the learners with well-structured activities. As such, the learners will be able to demonstrate the ability to comprehend specific knowledge, skills, and values. According to Anderson & Putman (2020) challenges experience by technology teachers include lack of technology knowledge.

According to Nkosi (2020), it is important that the teachers engage learners in activities that will use the design process. Mobarra (2018) concluded that the challenges faced by the Technology teachers are the lack of resources and the difficulty in grasping the technology concepts as a result of inadequate prior learning. Rauscher (2016:11) indicated that, "Technology teachers in South African Schools seem to have poor grasp of the complexity of this important part of knowledge that is specific to Technology". However, Jujuju (2021) indicates that the teachers have to be equipped with the knowledge of invoking prior knowledge, and that needs to be integrated for the benefit of learning. Based on the presented arguments, the study sought to

understand the challenges that the Technology education teachers faced when facilitating the subject.

Little literature around this focus has been short sighted. However, there are several studies done in technology education in South African schools. For instance, most of the studies looked at critical thinking skills (Kola, 2016); the integration of the indigenous knowledge system in technology teaching and learning (Gumbo, 2014); an emancipation framework for Technology education teachers (Mapotse, 2015); pre-service teachers in technology education (Ramaligela, Ogbonnay & Mji, 2019); The teaching and learning of Technology: Spotlight on sectional drawing among student teachers (Makgato, 2015) and the difficulties of student teachers in the engineering graphics and design course (Khoza & Makgato, 2016).

2.4 Conceptual framework

To explore how the Grade 9 Technology teachers facilitate Mini-PATs in the classroom, this study used Amineh and Asl's (2015) theory of constructive teaching and the 9E Instructional model (Ramaligela, Ogbonnaya & Mji, 2019). Amineh and Asl (2015) view the theory of constructive teaching as a personal construct system where the teacher needs to create situations that challenge the assumptions of traditional teaching to constructive teaching. According to Shah (2019), constructivist teaching is based on the constructivist learning theory where learning occurs when the learners are actively involved in a process of meaning and knowledge construction. According to Amineh and Asl (2015), to teach constructively, the teacher must engage the learners in learning, and guiding, as well as consider the learners' prior knowledge. Shah (2019) further explains that the constructivist teacher is a facilitator who considers the learners' needs and encourages peer interaction. Amineh and Asl (2015) indicate that the teacher should create situations in which the learners will question their own and each other's assumptions and built new knowledge through exploring and reflecting to form new ideas. This theory is relevant to this study since the Technology subject requires engaging in each assessment task in a constructive approach where the learners are required to explore, question their assumption, and reflect on various issues to build new knowledge. Therefore, constructive teaching in this study refers to the interactive transfer of ideas between the teacher and the

learners. Hence, this study sought to explore how the teachers facilitate Mini-PATs in their classroom through the lens of a constructive system.

Although the constructivism theory may be more relevant as a lens in this study, it does not fully allow the researcher to understand how each activity is facilitated in a constructive manner. To understand the teacher’s constructivism teaching system in each activity, the study proposes the 9E instructional model. Ramaligela et al. (2019) expanded the Eisenkraft (2003) 7E model to the 9E instructional model to investigate various settings. The 9E model can be used to investigate how knowledge is constructed through classroom practice. According to Ramaligela et al. (2019), the 9E instructional model is a measure to evaluate classroom instructional activities. Hence, this study will use the 9E instructional model to understand how technology teachers facilitate the design process skills in a constructive manner. As indicated by Ramaligela et al. (2019), the phases of the 9E instructional model are compatible with the Technology IDMEC design process. The phases that will be adapted from the 9E Instructional model are **elicit, engagement, exploration, enlightening, elaboration, evaluation, explanation, enclosure, and exchange** because the phases remain relevant to constructivist theory.

Table 2.1: The IDMEC technology design process and adapted 9E instructional model

IDMEC design Process and attained skills	9E phases involved (adapted)
Investigation Skills involved: Research Collecting information Analyse information Compare relevant information	Elicit Engaging Exploration Enlightening Exchange Evaluation Enclosure Explanation Elaboration
Design Skills involved: Collection of information through design Working drawings Compiling list of specification and constraints Drawing flow charts	Elicit Engaging Exploration Enlightening Exchange Evaluation Enclosure Explanation Elaborating

<p>Making</p> <p>Skills involved:</p> <p>Identifying tools and materials</p> <p>Listing safety precautions</p> <p>Measuring</p> <p>Scales</p> <p>Financial constraints</p>	<p>Elicit</p> <p>Engaging</p> <p>Exploration</p> <p>Enlightening</p> <p>Exchange</p> <p>Evaluation</p> <p>Enclosure</p> <p>Explanation</p> <p>Elaborating</p>
<p>Evaluating</p> <p>Skills involved:</p> <p>Effectiveness</p> <p>Verifications.</p> <p>Evaluate materials</p> <p>Safety of materials</p> <p>Strength and stability</p> <p>Comparing</p> <p>Evaluate instruments</p> <p>Assessment</p>	<p>Elicit</p> <p>Engaging</p> <p>Exchange</p> <p>Evaluation</p> <p>Enclosure</p>
<p>Communicating</p> <p>Skills involved:</p> <p>Presentation and demonstration</p> <p>(Sketches, plans, budget, model, and artistic impression)</p>	<p>Engaging</p> <p>Enclosure</p> <p>Explanation</p>

In this study, the **elicit phase** was explored within the investigation, design, make and evaluation stages where the teacher considered the learners' prior knowledge. The teacher uses different modes such as classroom interaction, pre-assessment, and multimedia strategies. The **engagement phase** was explored within the investigation, design, making, evaluating and communication stages where the teacher involves the learners throughout the lesson as active participants. The teacher uses provoking questions, problem-based methods, demonstration, and the discussion method to stimulate the learners' curiosity, interest, and attention. The **exploration phase** was explored within the investigation, design, making and evaluation stages where the teacher initiates activities and discusses the background and provides material as well as equipment. The teacher also addresses the learners' misconceptions. The teacher uses different modes such as conceptual connection, procedural connection, or equivalent representation to present new concepts.

The **enlightening phase** was explored within the investigation, design, making and the evaluation stages where the teacher refers to the use of the topic-specific

strategies. The teacher uses different strategies such as graphic presentations, visual representations, object presentations, static representations, and simulation methods to teach different concepts. The **elaboration phase** was explored within the investigation, design, making and evaluation stages where the teacher relates real-life experiences with the new concept within the classroom context. The teacher uses the learners' previous knowledge, personal experience, or their local knowledge to build their understanding of the new concept. The **evaluation phase** was explored within the investigation, design, making and the evaluation stages where the teacher determines the evidence of the learners' learning by assessing them. The teacher uses different evaluation modes such as the practical tasks, a concept focused task or a lesson outcome evaluation task to assess the learners' understanding of the different concepts. The **explanation phase** was explored within the investigation, design, making and the evaluation stages where the teacher explains to clarify the learners' misconceptions. The teacher uses different modes, such as argumentative, justification, descriptive or interpretive methods to explain different concepts. The **enclosure phase** was explored within the investigation, design, making, evaluation, and communication setups where the teacher summarises the concepts. The **exchange phase** was explored within the investigation, design, making and evaluation stages where the teacher uses the learners' ideas to identify misconceptions and further use them to correct the misconceptions. The teacher uses the learners' responses to build an understanding of the different concepts and also to correct the learners' misconceptions. As indicated earlier, the study adapted the 9E instructional model.

2.5 Summary of the chapter

This chapter discussed the literature on the introduction of the Mini-PATs in the Technology subject and the challenges faced by the Technology teachers when facilitating the hands-on practical tasks. The chapter further outlined the way Technology teachers are facilitating the Mini-PATs and the factors affecting the Technology teachers' ability when facilitating mini-practical assessment tasks. The literature also identified the gaps underpinned by the topic '*Challenges faced by Grade 9 Technology teachers' ability to facilitate Mini-Practical Assessment Tasks at Palala circuit schools, Limpopo province*'. In addition, this chapter discussed constructivism as the theoretical framework of the study which is concurrently supported by its

complementary 9E instructional model. Hence, the chapter gave a broader discussion of the 9E model in relevance to the technological processes and the skills attained in the process.

The next chapter provides a detailed discussion of qualitative research as the approach that is used in this study. the case study as a research design was used in the study. The next chapter also provides the details on the population in this study, purposive sampling as the sampling method in this study, as well as the semi-structured and non-participant observation as the method of collecting data in this study. Most importantly, the next chapter discusses how the qualitative data from the semi-structured and non-participant observation was analysed. It further discusses the trustworthiness of the qualitative instruments under the following: - credibility, transferability, confirmability, and dependability. Additionally, the chapter will discuss how permission to carry out the research was sought, and the informed consent, as well as how the participants were voluntarily participating. The issues of confidentiality and anonymity was are also handled.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the detailed research approach that was employed in this study, the research design that was used to explore how the Technology teachers facilitate the design process, the population where the sample was chosen, and the sample where the participants were chosen. This chapter also discusses the data collection techniques that were used in the qualitative approach. There is also a discussion on how the semi-structured interviews and the non-participant observation were carried out. This chapter also gives a clear description on how data from semi-structured and from non-participant observation was analysed. In this chapter, the trustworthiness of qualitative instruments is clearly outlined and discussed, that is, credibility, transferability, confirmability, and dependability. Lastly, this chapter will give a brief discussion on how ethical clearance was sought, and how the permission to carry out the study was sought. There is also a discussion on the procedure of informed consent for the participants, the information on the voluntary participation of participants and how confidentiality and anonymity were adhered to.

3.2 Research approach

This study employed a qualitative research approach. Qualitative research is a method of gathering non-numerical data, while focusing on meaning-making and on human elements (Denzin & Lincoln, 2005). According to Stake (2010), qualitative research focuses on generating descriptions and situational interpretations. This qualitative study was positioned on Stake's (1995) perspective of case study design, who defined a qualitative case study as a study that seeks a greater understanding of a case. Stake's qualitative case study is suitable for this study since the study sought to explore the multiple cases on how the Technology teachers facilitate the design process in the Technology classroom.

3.3 Research design

According to Stake (2008), a case study is developed to study the experience of real cases in real situations and the case is the members of the phenomenon. According to Thomas (2021), a case study is an inquiry that elevates a view of life in its complexity, and it breaks it into study sized chunks. Schoch (2020) defines a case

study as an in-depth investigation of a contemporary phenomenon within its real-life context. Urbaniec and Žur (2021) define an exploratory case study as a research that is conducted to have a better understanding of the existing problem. Hence, this study is used as an exploratory case study to explore how the Technology teachers facilitate the design process in the Technology classroom and to gain a deeper understanding on the challenges faced by the Technology teachers when facilitating design process.

3.4 Population

Shukla (2020) defines a population as a set or group of all the units on which the findings of the research are to be applied. A population of the study is comprised of the Grade 9 Technology teachers in the Waterberg district as the researcher sought to understand the study's concerns (Casteel & Bridier, 2021). The population is the total number of Grade 9 Technology teachers in the Waterberg district that were included in the study from where the sample was chosen (Carol & Iben, 2014). The Waterberg district has 149 schools and 15 circuits. Palala is one of the circuits and it has 23 high schools.

3.5 Sampling

Sampling is a technique of selecting a suitable representative part of a population to determine the characteristics of the whole population (Mugo, 2002). Sampling is a selected representative of the larger population of the Grade 9 Technology teachers in the Waterberg district (Acharya, Prakash, Saxena & Nigam, 2013). The sample in this study refers to the selected Grade 9 Technology teachers who participated in the study. This study used purposive sampling, which allows the researcher to select the participants based on specific purposes with the aim to address the research questions or the purpose of the study (Creswell, 2018; Carol & Iben, 2014). This study selected ten Technology teachers. The ten teachers participated in the interviews and four participants were further selected for observations. The sampling of four teachers for observation was done because the researcher wanted to observe two teachers who indicated that they were challenged when facilitating Mini-PAT and two teachers who indicated that they had limited challenges. The sampling of the participants who were observed was sampled after the interview analysis.

3.6 Data collection techniques

3.6.1 *Semi-structured interview*

A semi-structured interview refers to finding out the participants' opinion regarding the research questions (McIntosh & Morse, 2015). This study used the semi-structured interview because it enabled reciprocity between the interviewer and the participants. The interviewer was able to make follow-up questions based on the responses of the participant (Kallio, Pietilä, Johnson & Kangasniemi, 2016). The semi - structured interviews provided qualitative data and evidence on the Technology teachers' opinions, ideas, and experiences (Szombatová, 2016). An interview schedule was used where a set of semi-structured questions was drawn to understand the challenges that the Technology teachers experience when facilitating Mini-PAT. Interviewing helped in gaining in-depth data from the ten participants. The questions included the participants' biographical data, gender, age, education level, teaching experience in teaching Technology and information about the classroom experience.

3.6.2 *Non-participant observations*

In non-participant observation, the researcher was on the outside looking, and not taking part in the classroom practice (Busetto, Wick & Gumbinger, 2020). This study used non-participant observations because the researcher was not involved in the teaching (Ciesielska, Boström & Öhlander, 2018). The non-participant observation method was used to explore how the Technology teachers facilitated Mini-PAT in their classroom because the observation enabled the researcher to gather enough information on a wide range of phenomena (Ciesielska et al., 2018). The researcher used field notes to capture the activities that were unfolding in the classroom, since videos or visuals are prohibited in most schools. Furthermore, the observation schedules were developed to elicit important information that was used to answer the research question. As indicated earlier, the study used the 9E instructional model as a conceptual framework for this study, and it was used as a guide to develop an observation schedule.

3.7 Data analysis

3.7.1 *Semi-structured interviews*

The semi-structured interviews employed a deductive analysis approach since the structured themes from the 9E instructional model were predetermined (Azungah, (2018) and they were used to develop the interview schedule and to present data. The interview tape-recorded data was manually transcribed into word form. The data was textually analysed and displayed as verbatim quotes from the interviews. Verbatim quotes are suitable for the study because they are commonly used in educational research to provide descriptive data (Carol & Iben, 2014). The interview transcripts were coded by reading through the data, categorising it into codes and interpreting it by using memos for clarification (Stucky, 2015). The coding helped to compile the descriptive information during the study. The themes were drawn from the 9E instructional model while the categories were drawn from the IDMEC process because the researcher started to detect patterns in the data and to develop conclusions.

3.7.2 *Non-participant observations*

The lessons observed from the four participants were analysed through the deductive analysis. According to Azungah (2018), a deductive analysis requires a structured or predetermined approach. The researcher used field notes where the activities that were unfolding in the classroom were captured, and the observation schedules were developed to elicit important information that was used to answer research question 2. The notes were manually transcribed into a narrative story text form, quoting the exact statements that were provided by the participants during their classroom practice (Creswell, 2018). The narrative data is presented in Chapter 4. The study analysed the data according to the themes that were drawn from the 9E instructional model, and the categories were drawn from the IDMEC process. It further discussed the findings to understand how the teachers employed the theory of constructive teaching in their classroom practice. The themes and the categories from the field notes were used to understand the teachers' mode of facilitating the Mini-PAT and to present data.

3.8 Trustworthiness of the qualitative instruments

3.8.1 *Credibility*

According to Shenton (2004), credibility is the development of familiarity with the

participants serving as informants in the sequential data collection. Credibility during data collection and during data analysis is when transcripts from semi-structured interviews and non-participant observations measure maximum accuracy where the participants verify the comments they made during the interviews. The participants were asked to confirm the data that was obtained during the data collection and the interview interpretation period (Madrazo-Pérez, Parás-Bravo, Rayón-Valpuesta, Blanco-Fraile & Palacios-Ceña, 2019). There was prolonged engagement prior to the collection of data to ensure a mutual relationship between the researcher and the participants to limit anxiety. The researcher first established a good relationship with the teachers prior to the collection of the data. Secondly, the researchers attended 2-3 lessons with the teacher to alleviate anxiety before the actual observation (Shenton, 2004).

3.8.2 *Transferability*

Transferability is the provision of background data to establish the context of the study and to give a detailed description of the phenomenon in the research questions for comparison (Shenton, 2004). Transferability was applied when the findings of the study were used in other situations as a demonstration of flexibility to a wider-range population, that was informed by in-depth descriptions of the study, giving details of the participants, context, sampling strategies, and the data collection and analysis procedures (Madrazo-Pérez et al., 2019).

3.8.3 *Dependability*

Dependability is the application of an in-depth methodological description to allow the study to be used again (Shenton, 2004). The dependability of this study was strengthened by the fact that the interview questions and the observation schedule focused on the same aim in which the same categories were found in both techniques (LoBiondo-Wood et al., 2009). These included comparing data and the revision process until the final classification emerged. Dependability was also enhanced by the supervisor evaluating the consistency of the process and the research product (Creswell, 2013). The supervisor cross-checked the raw data that was available. In addition, the use of overlapping methods to collect data and to report the processes within the study also ascertained credibility and dependability in this study. Furthermore, the researcher also used the literature to verify if the other researcher

has similar views about the interpretation of the data.

3.8.4 Confirmability

Confirmability is the use of sequential data to reduce the effect of the researcher to be biased in the study (Shenton, 2004). Confirmability includes more details to the reader on how the data was gathered to verify the similarities of conclusions (Carol & Iben, 2014). Confirmability in the study was reflected when the participants were showing confidence on the findings of the study by narrating the findings to avoid the researcher's biases. The conformability of the results was enhanced by taking everything back to the participants and checking with them whether what the researcher interpreted was what they had said (LoBiondo-Wood et al., 2009). Conformability was also enhanced by the fact that the interviews and the observations data was collected, transcribed, and analysed by the researcher (LoBiondo-Wood et al., 2009).

3.9 Ethical consideration

3.9.1 Permission to carry out the research

Ethics is the consideration of implications of the ethical principles of respect for humans, beneficence, and justice within the study (Williams, 2000). Ethical clearance was sought from the Turfloop Research Ethics Committee (TREC). Lastly, permission was requested from the Limpopo DBE, Waterberg District (Palala Circuit).

3.9.2 Informed consent

Informed consent can be defined as a procedure in which the participants in a study are given important details about the study including the risks and benefits before, they can choose whether to participate in a study (Nnebue, 2010). Xu, Baysari, Stocker, Leow, Day and Carland (2020) define informed consent as a way of making sure the participants are aware of what is done, and they decide if they want to participate or not. All the Grade 9 Technology teachers were made aware of what the informed consent form is, and they were asked to fill in the consent form that was obtainable from the University of Limpopo's postgraduate guide. The participants were informed that they can withdraw from the study at any time. The researcher ensured that the participants were fully aware of the rationale of the study in a form that they can understand the importance of the study (Connelly, 2014). The informed consent form

from the University of Limpopo was issued to each participant.

3.9.3 *Voluntarily participation*

No participants were coerced to take part in the study (Babbie,2016). The participants were allowed to consent and later to withdraw if they want to and no questions were asked. The participants need to understand their role and the nature of the study to be fully aware of what the study entails. The researcher would not lie or deceive the participants under any circumstance (Babbie, 2016).

3.9.4 *Confidentiality and anonymity*

All the data that was collected was confidential and the participants' names were not used as pseudonyms were utilised to identify the participants (Connelly, 2014). The data in the study was only used for the purpose of the study, and no subject identity was linked with personal responses (Babbie, 2016). All the field notes that were taken during the observation period will be safe guarded in the university for a period of five years and will only be accessible to the researcher and the supervisor(s).

3.10 Summary of the chapter

This chapter discussed the detailed qualitative approach that was used and the research design that was employed in this study. The population, sample, the sampling method as well as the data collection techniques were discussed. Data analysis, the trustworthiness of the qualitative instruments as well as the ethical consideration were clearly outlined. The next chapter provides a detailed discussion of the teachers' responses from the semi-structured interviews to understand the challenges faced by the Technology teachers' experiences when facilitating the Mini-PAT responding to Research Question 1 (RQ1) and the field notes on the activities that unfolded in the classroom using the non-participant observation method responding to Research Question 2 (RQ2).

CHAPTER 4: PRESENTATION OF DATA

4.1 Introduction

This chapter presents the data of the case study that explored the challenges faced by the Grade 9 Technology teachers' ability to facilitate learning. This chapter presents the results of the semi structured interviews and the non-participant observations. The results from the semi-structured interviews focused on Research Question 1 (RQ1) and the non-participants' observation focused on Research Question 2 (RQ2). The main findings are presented below.

4.2 Research question 1:

Research question 1 looked at the challenges faced by the Grade 9 Technology teachers when facilitating the design process. As indicated earlier, the research question was answered through the interview technique. The data is presented according to the 9E instructional model phase as themes and according to the IDMEC process as categories.

4.2.1 Elicit phase

As indicated in Chapter 2, the elicit phase looked at how the teacher seeks to understand the learners' prior knowledge to find out what they already know. To understand the teachers' mode of eliciting the learners' prior knowledge, the researcher looked at two (2) questions.

Question 1 *"How do you elicit the learners' prior knowledge when facilitating the investigation, design making and evaluation stages?"*. **Question 2** *"Which teaching mode do they use to elicit the learners' prior knowledge when facilitating the investigation, making and evaluation stages"*. The question further requires the teachers to elaborate. The below sections show how the teachers responded based on the following categories:

4.2.1.1 Investigation stage

When looking at how the teachers elicit the learners' prior knowledge when facilitating investigation, the data revealed that **7/10** teachers were able to consider the learners' prior knowledge. For instance, the teachers indicated that to elicit the learners' prior knowledge they used questions and a baseline assessment to find out what they have

been taught. When asked which teaching mode, they use to eliciting the learners' prior knowledge, the teachers indicated that they use the base line assessment for instants:

Respondent 1 said that in investigation stage, *"I will find out what they have been taught at the lower grades and ask them to give examples, when they manage to give correct examples, I will know that they understand structures"*. When asked which teaching mode he use to eliciting learners' prior knowledge, the teacher said that *"Technology is practical it depends on the topic when dealing with structures ,gears or plastics let me give an example, when dealing with plastics learners have prior knowledge of the number but they do not know what the numbers stands for, then I have to come and explain to them what the number mean in terms of plastics"*.

Respondent 3 said that, in the investigation stage, *"As an educator at the beginning of the year or semester or terms you must do baseline assessment which is to assess learners' prior knowledge so you must identify what is it the learners has at the moment before you introduce a particular topic that you want to facilitate during that time. What I am going to come up with is baseline assessment to be used at the beginning of the semester or at the beginning of the year or at term"*.

Respondent 5. said that, in the investigation stage, *"I take my learners back through what they know, I normally give them topics after giving them topics I also ask them questions based on that topic what they know the what, the how and when we are talking about investigation is when we are trying to find or to get knowledge of something that we are not sure of or we don't know we are trying to get more information about that particular topic. What I usually do in class I ask them question if they to the point where they don't know the answer, I tell them go and investigate about this"*.

Respondent 6 said that *"Firstly is to give learners a glue on what they did previously and remind them what they did before"*.

Respondent 8 said that, in investigation stage *"I will draw learners' prior knowledge by asking learners what investigation is and look at their responses and is where I will get their prior knowledge from then"*. When asked which teaching mode, he uses to

eliciting learners' prior knowledge.

Respondent 10 said that *"As an educator at the beginning of the year or the semester or a term, I will do base line assessment assessing learners' prior knowledge, I must identify what learners have before at the moment before introducing a particular topic depends on what I want to facilitate at that particular time. what I am going to come up is baseline assessment that will be used at the beginning of the semester or maybe at the beginning of the of a year or a term"*.

Respondent 2 said that *"When your present investigation there are few things to bring forth so that the learners be in a position to investigate that particular object you want them to investigate, you must give learners things that they can look into so that they get deeper into in order to investigate that particular object"*.

However, **3/10** teachers did not consider the learners' prior knowledge. For example:

Respondent 4 said that, in the investigation stage *"By using classwork and check performance or can be a test or many tasks"* when asked which teaching mode, he uses to elicit the learners' prior knowledge.

Respondent 7 said that, in the investigation stage, *"Investigation is all about doing the research, so while the learners are doing research, they must have investigative question before they will go further"*. When asked which teaching mode, he uses to elicit the learners' prior knowledge.

Respondent 9 said that, in the investigation stage *"I will have to let them gather any information they will need for their design process in technology, I will give them the freedom to do whatever it takes so that they will be able to understand what that for the problem is to have a solution"*.

4.2.1.2 Design stage

When looking at how the teachers elicit the learners' prior knowledge when facilitating designing, the data revealed that **6/10** teachers were able to consider the learners' prior knowledge. The data indicated that during the design stage, the teachers find out what they have been taught in lower grades which then assists them to assess the learners' prior knowledge. For instance:

Respondent 1 said that *“As technologists we have design process IDMEC, one thing I ask them is to find the problem within the school, I will ask learners to design a desk where they will put their bags and make them know that Technology is about problem solving so that you investigate it and design what you want to make”*.

Respondent 2 said that *“Planning mean developing things like objects on a paper so that when you are developing make you know exactly what you are going to make. You must make sure that learners are interested in that particular object because they are in the position of investigated it, they must be able to design or draw it on a paper”*. The teacher further emphasised by saying, *“In design stage drawings are involved”*.

Respondent 4 said that *“The way of answering question types of lines and measurements”*.

Respondent 5 said that, in the design stage *“From what they investigated they must have a picture that will be another form of transforming the known information as a theory now they will be taking it into a diagrammatical they will be drawing it down. From what they know I will say to them, the very thing that you have researched you can design it based on the information you are having may you please give us the structure of what you’ve researched or the information you have investigated”*.

Respondent 10 said that *“In designing stage I will give learners scenario, maybe less I want learners to construct a bridge that’s an example then there must be some material that must be used by learners to construct whatever task that may be given which means the materials should be in place learners should be knowing what type of materials should apply at that particular moment “*.

Respondent 7 said that *“Before something can make something they have to design, there are certain techniques when designing I will teach learners how to hold a pencil and pens that one of the important things”*.

However, 4/10 teachers did not consider the learners’ prior knowledge when facilitating the design stage for example:

Respondent 8 highlighted that, *“I will continue doing the same as I did in investigation, I will ask can you design and tell the steps how to design”*.

Respondent 9 stated that, in the design stage *“We to give any chance to give learners to do at their own pace in order for them to develop or formulate a design brief which is effective for them before their actual process and in order to describe everything and state the parameter that will be required in the whole process in technology”*.

Respondent 3 stipulated that, in the design stage *“You give learners scenario maybe you want learners to construct a bridge then there must be materials that must be in place in order for individual to be able to construct whatever task they have been given. Which mean the material should be in place the learners should be knowing what type of materials should be apply at that moment”*.

Respondent 6 said that, in the design stage *“Tell the learners teach the learners the name of the tools and show them what are you talking and tell them how to handle and use and teach them about the safety”*.

4.2.1.3 Making stage

When looking at how one elicits the learners’ prior knowledge when facilitating the making stage, the data revealed that 5/10 teachers indicated that they were able to consider the learners’ prior knowledge. The data indicated that the teachers find out what they have been taught and they also encourage the learners to consider what they have drawn to practically make it observe the safety measures which assist them to assess the learners’ prior knowledge. For example:

Responded 1 said that, in the making stage *“I will ask learners what you did in primary school as a project. Making mean leaners arrange a structure or whatever you do make sure you present it, that is how eliciting learners’ prior knowledge when facilitating making stage.”* The teacher further emphasises saying *technology is continuous from grade 7 to grade 9”*.

Responded 2 stipulated that, in the making stage *“Making result in be in a position of doing it in your own hands, the learners use the information they have investigated and once they have that information investigated, they have tried to design it on a paper for example. In making there must be a visible object out of that investigation and designing for example when they make a bridge then the learners can use card box and other things like wires so that they can show you what is a bridge they will*

show you that water pass underneath, and cars will pass above. The reason is that your make resembles exactly what you have designed and what you have already investigated it is not easy to make something that you dint investigate”.

Responded 4 highlighted that, *“Since I teach technology from grade 8, I know this one is better in drawing a bridge and this is better in making, meaning I know from the previous those what is good in”.*

Responded 6 said that, in the making stage *“whatever they do in practical you to be there and look over them and observe their safety if they apply what they have taught before”.*

Responded 8 stated that, in the making stage *“In the process of making I will hear from their responses what making is all about, if they have misconception during their explanation”.*

However, **5/10** teachers were unable to indicate how they consider the learners’ prior knowledge. For instance:

Responded 3 said that, in the making stage *“The learners feel comfortable if the educator is there to facilitate the process. so, what I will be doing there to facilitate the planning as an educator what I can basically do is to come up with diagnostic assessment or maybe formative assessment then is going to help me and leaners to identify what is that they are capable of doing in that moment. The teacher will be observing and identifying the barriers of the learners. I will give them task e.g., a house. The learners won’t be knowing where to start then I have to guide”.*

Responded 5 said *“I normally tell my learners whatever they are investigating is makeable or it can be built into something which is real. So, I normally start using papers when doing the making part on the making state, I normally use the papers which they can built for example when they are doing bridges, I will say use this papers put them together to make a bridge then after that when I know they got an idea is when I can say use any material to make that particular product”.*

Responded 7 said *“I will be watching while gathering the correct equipment needed”.*

Responded 9 stated that, *“Since we know that in making stage that’s where we are going to need the basic skills and also the knowledge of the learners about the designer is required, that’s where the learners will know the specific sequence that is correct in order for them to start specifying whatever that need to be specified on their design brief because everything need to be related to the design brief because the design brief it actually consists of the whole description of the design”*.

Responded 10 highlighted that, in the making stage *“The learners feel comfortable when the educator is there to facilitate the process. So what I will be doing there is to facilitate the planning as the educator I can basically know and to come with a is going to diagnostic assessment or maybe a formative e assessment help me and the learners to identify what is it they are capable of doing in that moment and then I will be observing and identifying the barriers of the learners, I will give them a task example let’s say a house then I will be knowing where to start then I will give guidance in that moment”*.

4.2.1.4 Evaluation stage

When looking at how one elicits the learners’ prior knowledge when facilitating evaluation, the data revealed that 7/10 teachers were able to elicit the learners’ prior knowledge. The data indicated that when the teachers facilitate the evaluation stage, they are able to indicate that they evaluate and assess the learners through the summative assessment to evaluate the learners’ knowledge. For instance:

Respondent 1 - *“The evaluation mean costing, you cost the material that you are going to use, when you design, I will tell the learners when you design you have to understand the cost of material, how much the labourer. so that they have an idea what they have to present”*.

Respondent 2 - *“Prefers to you access whatever you have done it is good or it is not good”*.

Respondent 3 - *“I evaluate what is it you have done, so now you want to establish the outcome of your activities. The summative assessment to use to promote or retain the learners”*.

Respondent 4 - *“We use lots of tools to evaluate, you create a tool a checklist for in case, by ticking where the quality is applicable”.*

Respondent 5 - *“I normally say to my learners when doing a project mark, yourself or give yourself some marks before you bring it to me in terms of what, is that product project suitable? is its strength? is it stable? Is it rigid? All those questions I want them to understand in order for them to have a final product. By giving them rubric, it helps themselves to evaluate themselves before it comes to me”.*

Respondent 9 - *“Since we know that evaluation we are talking about where we have the product or the model where you modify and make certain change. As for me I will actually leave them alone to do whatever they think will not be right from there I will come again and the check if ever they made a change that I expected so if they did the correct that where I will give them a clear answer. So, I have to give them freedom when evaluating the model”.*

Respondent 10 - *“I will evaluate what is it the learners task done so that I can establish the outcomes of the activity that they have performed this might have been done through summative assessment to promote or retain the learners”.*

However, **3/10** teachers were unable to indicate how they consider the learners' prior knowledge. For example, some teachers focused on the learners' conclusion and clarifying learners.

Respondent 7, said, in the evaluation stage *“I all about conclusion, I will ask them what they can conclude from investigation to designing to making what is their conclusion on that I will ask questions”.*

Respondent 8 - *“On evaluation learners will have word game, their pronunciation, I will ask them when we evaluate what are we doing, they will respond in their response I will know what they know, then I will be clarifying if they are in the right path or not”.*

In this theme, the researcher further asked the teachers, *“Which teaching mode do you use to elicit learners' prior knowledge when facilitating, investigation, making, and evaluation?”.*

The response below shows how each teacher responded based on the following categories:

4.2.2.1.1 Investigation stage

When looking at the teachers teaching mode to elicit the learners' prior knowledge when facilitating investigation, the data revealed that 7/10 teachers indicated that they are able to use different teaching modes to elicit the learners' prior knowledge when facilitating investigation. The data indicated that the teachers use practical activities to elicit the learners' prior knowledge. For instance:

Respondent 5 said that, *"I will use problem solving mode, the reason being that when investigating there is lot of information you don't know about the project then you are trying to get the information but on that information you need to find the solution on what you know thoroughly about the project and how and the project that you are doing technology is made to enhance a better living which means that you have to have new ideas. In answering the how? what? and where? you will be solving a certain problem using the investigation"*.

Respondent 6 - *"One on one method, tell one learner and check the level of understanding and mix it with teamwork for practically"*.

Respondent 2 - *"Since I am 59 nine years old in our language, we use the word mode the teaching method in other words we bring all the methods that we will use in order to teach this learners the aspects as alluded for example when we talk of investigation what type of a method, we can use to learners so that they must instigate an object whatever you want them to investigate. What you going to do you apply question and answer method so what you do you ask them questions that will lead them to what you want, and they will keep on answering if they fail that question-and-answer method you bring another type of method called narrative in order words you explain briefly what you think the learners might know. But you need to consider it when you deal with investigation so that the learners must investigate you must primarily try to use question and answer method, you must not base much on narrative as you use question and answer method learners will be in a position to bring ideas what they are going to investigate, how are they going to design that particular aspect. Every time you look at this learner you must start from the known to the unknown"*.

Respondent 8 - *"I will use questioning in the absence of activities I will use questioning method. I will question them orally so when they answer it will depend on if the answers are correct or not. I will then not assess immediately, if I am asking them orally and not assess them immediately, I will encourage other learners to give their inputs".*

Respondent 3 - *"I am going to use teacher demonstration in teacher demonstration I can come in class and introduce a topic. I will use demonstration and imposing questions".*

Respondent 10 - *"I am going to use demonstration I am going to demonstrate; I can come in in class and introduce a topic and then I will use demonstration and imposing some questions".*

Respondent 4 said that, in the investigation stage "I give learners guidelines".

However, 3/10 teachers were unable to consider any teaching mode to elicit the learners' prior knowledge. For instance:

Respondent 9 said that *"First of all investigation is based on researching that's where you take there and there and combine it together in order to get whatever that is going to be needed. In order to find their prior knowledge is when you use direct instruction you will tell them everything directly, so you explain everything whatever that is going to be needed".*

Respondent 7 - *"I will take the authority mode whereby myself as an educator I will take a leading part. Remember I am trying to elicit to check their prior knowledge though I have to use the authority mode whereby myself I am in charge I am in lead, before they get that comfort, so I am taking the lead so that I will be able to know their strength and weaknesses".*

4.2.1.4.1 Making stage

When looking at the teachers' teaching mode to elicit the learners' prior knowledge when facilitating the making stage, the data revealed that 3/10 teachers indicated that they are able to use the teaching mode to elicit the learners' prior knowledge. The data indicated that the teachers were able to indicate that they used demonstrations and they gave the learners a guide. For instance:

Respondent 5 said that, in the making stage *“I use demonstration method which will allow my learners to perform in their fullest potential because when I use demonstration I will be showing them how to do that particular bridge but then I will encourage them to do better than me since I will be doing mine but mine will be simple I will demonstrate how I put my material together which material will, be suitable to use then they will go to the next level”*.

Respondent 7 - *“Is all about demonstration, they are the one who are the ones who will be making whatever they will be making I will apply the demonstration method, the demonstration method is whereby simply by giving them the guidelines what is it they must do and not do, channelling them into the right direction for the making part”*.

Respondent 8 - *“I will demonstrate, and I will use questioning, on demonstration I will making a box and asking them what this is they will respond”*.

However, 7/10 teachers were unable to consider the teaching mode to elicit the learners' prior knowledge. For instance:

Respondent 1 stated that, in the making stage *“I tell learners do we use plastic bags and I make them understand about recycling”*.

Respondent 2 - *“What must they do when they are making”*.

Respondent 3 - *“Handwritten work you have to control what the learners have wrote”*.

Respondent 4 - *“- I do something in front of them even drawing”*.

Respondent 6 - *“We have different material to develop a product, for example I give them a practical you must go and make a bridge. I tell the learners there are different material to make a bridge. I give them the platform or an opportunity to use whatever they want to you or suitable for the bridge”*.

Respondent 9 - *“Since when we know that in making stage we are able to use tools we use hands we go up and down there learners will be going there and there picking up certain equipment, the cooperative learning that's where it can be involved together with object based learning because that's where we will be working on the model the model is in the form of project because at first it was stated by the design brief*

immediately you hear the word design that's where you hear that here I must make a project".

Respondent 10 - *"Through handwritten work where I will be busy controlling the learners what they have done".*

4.2.1.4.2 Evaluation stage

The study also looked at the teachers' teaching mode to elicit the learners' prior knowledge when facilitating the evaluation stage. The data indicated that 6/10 teachers indicated that they are able to use different teaching modes to facilitate the evaluation state, for example the teachers indicated that they use the learners' demonstrations and assessing the product as well as comparing. For instance:

Respondent 1 said that, in the evaluation stage *"The teaching mode is practical, I tell the learners that they can use plastic to make a hat and ask them how much the plastic is. I will make them to understand budgeting in terms of costing which means they will be evaluating".* Their prior knowledge is that plastic can be recycled, use to carry books to school. I give them another idea on use of plastic".

The teacher further emphasised on the effectiveness of plastic he said, *"You can also evaluate the quality of material".*

Respondent 3 - *"I assess the learners on what they have learned it has to be a written work".*

Respondent 4 - *"I give learners rubric".*

Respondent 5 - *"I will adapt demonstration and also problem-solving reason being that when you evaluate you need to test that project they are having and if ever the product is not suitable is not rigid enough is not stable it means you have to come with other solution to make it more suitable to be used".*

Respondent 6 - *"You must make something that will show them what is expected from them, me as a teacher I demonstrate what is expected from you. You compare if it exactly I want the way I want it to be".*

Respondent 7 - *“Is all about the assessing, assessing what they have actually done or what they actually know. Assessing can be done in various manner, I can say if I assess their prior knowledge, I can use rubric, I can rely on rubric since it will contain all components”.*

However, 4/10 teachers were unable to consider the teaching mode in eliciting the learners’ prior knowledge when facilitating the evaluation stage. For instance:

Respondent 8 - *“I will just make an object if I evaluate it lets take a box and show it to my learners and tell them lets evaluate or how to evaluate if they know how to evaluate the box from there, I will know they are correct”.*

Respondent 9 - *“On evaluation since we know that that’s where we involve the improvement of our project on whatever we are designing actually also including their interest design process so that they will also like it if you notify it, maybe if you will use enquiry base learning it will be appropriate for this stage called e valuation in the design process that where learners they will ask questions which are appropriate and somewhere somehow the product will be tested fairly so if they have some questions and they will also answer them and some questions will be answered by their own peers and also myself I will be answering”.*

Respondent 10 - *“Through evaluation state I will assess learners what they have learned which have to be a written work, remember in making I will give them a handwritten work I will evaluate them through handwritten work”.*

Respondent 2 - *“How is this going to be evaluated”.*

4.2.2 Engaging Phase

In this theme, the researcher asked the teachers, *“How do you keep learners as active participants when facilitating investigation, design, making, evaluation, and communication stages?”*. The response below shows how each teacher responded based on the following categories:

4.2.2.1 Investigate stage

When looking at how the teachers keep the learners as active participants when facilitating on investigation, the data revealed that 5/10 teachers indicated that they

are able to keep the learners as active participants when facilitating Investigation. The data indicated that the teachers allow the learners to work on activities that they will be analysing and comparing. For instance:

Participant 1 said that, in investigation *“I ask them what is the that you see around, then ask them what they can do about the problem identified”*.

The teacher further explained by saying, *“You give them a problem and they come with ideas how to solve it”*.

Participant 2 - *“Yes, learners should be kept as active participants they should be kept highly involved, you cannot keep them highly involved when they don’t explore, learners must have the ability to explore new information and this information will make them more interest in doing that particular in investigation”*.

Participant 3 - *“Learners learn through different mode of teaching; some learners are good in doing activities while some are good in handwritten work. so, you must come with activities that is practical at some point so that all learners feel comfortable and interested in learning the subject. Without practical’s technology become impossible”*.

Participant 7 - *“In most cases they have to be hands on, to allow them to investigate to do research, ask one person can be a learner even a teacher jut to get more information that they need. I don’t have to tell them what to do or not. I will be giving them that freedom that platform to ask various people to get various answer to find out the relevant answer”*.

Participant 10 - *“Learners learn through different mode of teaching some learners are good in doing activities while some are good in handwritten work so I will come with activities that are more practical at some point so that all learners feel comfortable and interest in learning the subject, so without practical technology become impossible”*.

However, 5/10 teachers were unable to keep the learners as active participants when facilitating the investigation stage. For instance:

Participant 4 - *“Since some learners are very shy, I will first say don’t feel fear feel free to participate. I will keep on encouraging them and point one by one to stand up and explain how they did it”.*

Participant 5 - *“Technology learners they love getting attention when you ask them questions individually not leaving any one behind asking them what they think they will be more interested and more hands on whatever the investigation they will be doing”.*

Participant 6 - *“You have to motivate the learners, whatever what he she does you just praise the learner. Then the learner will be motivated and gain interest and willing to learn”.*

Participant 8 - *“The lesson should be learner centre the learner should do the work on their own. Then I will be evaluating their moderator”.*

Participant 9 - *“First of all whenever I am starting to introduce a certain case study about a certain model to be required to be designed, I will have to give them the case study in order for themselves to understand without me explain to them so that they can grasp some certain concept, because we know in the most cases learners they come to class with their own conception, so us as teachers we going to clarify them with conception so we have to give them handout on whatever they think they may know”.*

4.2.2.2 Design stage

When looking at how the teachers keep the learners as active participants when facilitating the design stage, the data revealed that 6/10 teachers indicated that they are able to keep the learners as active participants by involving them in drawing activities. The data indicated that the teachers engage the learners in drawing sketches. For instance:

Participant 1 - *“I just take a piece of paper and say draw the thing that you are talking about, in drawing everyone is engaged”.*

Participant 3 - *“When you design you come with an idea what type of the model you want to produce by drawing a sketch of the object. Is the matter of using pencil, rubber, and ruler. Meaning learners will be drawing”.*

Participant 5 - *“I will allow my learners to cum up with ideas or their own design of the project they are having in mind, and they will be drawing, and I will allow them to explain to me which material will be used, what is this and how did they come up with that idea because I believe that in technology every project will be unique”.*

Participant 6 - *“Learner is very good, actually u ask the learners to design the house, I will make an example by drawing it on the board to show them the dimensions”.*

Participant 7 - *“They enjoy part of drawing: I divide them in groups. If I group them individually, they will assign one to draw from there they will compare their drawings”.*

Participant 10 - *“On this stage I will come with idea of what type of a model I want to be drawing the sketch of the object. This is the matter of using pencil, ruler and rubber meaning learners will be drawing in this design stage”.*

However, 4/10 teachers were unable to keep the learners as active participants when facilitating the design stage. For instance:

Participant 8 - *“They should also be as active participants, I have to guide them, I must not take their stand I have to guide”.*

Participant 9 - *“On design stage we let learners to imagine the model or the product. And thorough this imagination pf this model or product it will lead to creativity in their minds from there is where they will have different ideas and then of the model since they were brainstorming so this imagination will let them to create object in their mindset and then from there later on, they can find the possible solution of the problem then that’s where they will move on”.*

4.2.2.3 Making stage

When looking at how the teachers keep the learners as active participants when facilitating the making stage, the data revealed that 5/10 teachers indicated that they are able to keep the learners as active participants when facilitating the making stage. The data indicated that the teachers involve the learners in identifying the tools and the materials that are required in their activities. For instance:

Participant 1 - *“I group them and give them rulers, scissors and instruct them to cut and glue them in that I create the ability to work together to achieve a common goal”.*

Participant 3 - *“Is the construction the type of the material has an influence”.*

Participant 5 - *“Every learner will have a desire in that because is hands on they will believe it they will make this after making a design they will want to produce exactly what they have designed after the design have been approved. so, I will my learners and give them enough material and go extra mile and make whatever they want. And in that I will be allowing them to use their own ideas”.*

Participant 9 - *“In the making stage in the most cases that’s where we are manufacturing this learners they have to go up and down give us the equipment or maybe they will go together in collaboration in a group so that they can plan and come with new ideas so that later on they can also design or include the limitation or the constrains that required for the design due to their design brief and the specifications because we don’t have to exceed the specifications. Because specifications will tell you how the product or the model will at the end also including the cost and everything”.*

Participant 10 - *“In this making stage is the construction time and the material, the learners will be constructing the sketch”.*

However, 5/10 teachers were unable to keep the learners as active participants when facilitating the making stage. For instance:

Participant 2 - *“Learners should be in the position that they can make objects that they don’t even know because you will be starting with objects that they know to that they don’t know, and you will go up in those particular making until they arrive at things that are a little bit complex”.*

Participant 4 - *“They must do it and explain it how they did it”.*

Participant 6 - *“By motivating them that they will be selling this bridges the moment you tell them that they will be selling the bridges they will do their best”.*

Participant 7 - *“Grouping them, some will automatically volunteer to bring this part then each will be participating”.*

Participant 8 - *“My learners should be at all times be at the centre of learning, in terms of making I will be there just to guide them, they must be at the centres. They are more hands-on activities”.*

4.2.2.4 Evaluation stage

When looking at how the teachers keep the learners as active participants when facilitating the evaluation stage. The data revealed that 3/10 teachers indicated that they were able to keep the learners as active participants when facilitating the evaluation stage. The data indicated that the teachers evaluate material and record their findings on practical activities. For instance:

Participant 1 - *“Learners will have evaluating different types of wood together with their prices and provokes the idea that I won’t use white wood because is cheaper but will not last and the brown wood is expensive but will last and they look at the environment if there are termites”.*

The teachers further emphasise by saying, *“Learners will start thinking, they will think on the product how the product is, how to protect the product”.*

Participant 3 - *“- There will be recording the outcomes and the findings of the practical. Encouraging learners that they work for earning marks”.*

Participant 5 - *“I will have them individually using demonstrating using their very own project to tell us what it is used for? Why did they try to use that material? Is it suitable? does it solve the problem? That has been investigated, is that what they wanted to have in then beginning if that is then case, I will say the project is suitable. If it caters the rubric, it means that the project is suitable to be used”.*

However, 7/10 teachers were unable to keep the learners as active participants when facilitating the evaluation stage. For instance:

Participant 2 - *“When you deal with the position of evaluation, they must be in the position to evaluate it”.*

Participant 6 - *“You must give them interest in what every they are doing”.*

Participant 7 - *“I give them the platform of presenting the work give them that opportunity as a group”.*

Participant 8 - *“I will just say as learners evaluate each other’s work or projects they will be reporting on the object then I will clarify”.*

Participant 9 - *“In evaluation that’s where we start to collaborate the learners will start to ask themselves questions, in this required project they will start to go back to the design brief and check the specifications and say this is not needed and cut it off and they ask other questions does it look like the one we have drawn in our sketch? Then if yes that’s where they will tick right, if wrong they will start to modify it fairly so”.*

Participant 10 - *“In this evaluation stage there will be the outcome and the finding at the end. I will also encourage learners to work to earn some marks so through this recording I can be able to evaluate what learners have done at that point before they can design remember on the design stage have”.*

4.2.2.5 Communication stage

When looking at how the teachers keep the learners as active participants when facilitating the communication stage, the data revealed that 4/10 teachers indicated that they are capable of keeping the learners as active participants when facilitating the communication stage. The data indicated that the teachers give the learners a chance to present their projects in groups. For instance:

Participant 1 - *“This can be done by presentation, so they are in a group present what they have done. They would have agreed on what to present so that anyone can be able to present”.*

Participant 4 - *“Call them to present in front of them”.*

Participant 7 - *“They will be presenting their project as a group, where every learner will be given a role in a group”.*

Participant 8 - *“I will just let learners to communicate, presenting their work”.*

However, 6/10 teachers did not consider keeping the learners as active participants when facilitating the communication stage. For instance:

Participant 9 - *“We know all of us that in technological design process is a circle of steps that it helps designers to create product. So, the product you cannot create if you do not prepare the solution. So, my learners they will then prepare their solution and by sharing the ideas that’s why they will come up with second choice which improve their product even if the second option holds and larger audience. This stage is where we make a final change and say here, we change and after that change there is no other change. So, my learners will be improving it and giving each other the results and their opinions on what they have changed how does it look at the end according to their imagination I have to give them chance to change and give them result of whatever they have thought about later”.*

Participant 10 - *“I will be expecting everyone to know the basics of English and I will be encouraging this learners in verbal and no verbal communication more learners are good in non-verbal communication especially in rural areas we are experience more learners they are still struggling in communication particularly in English, so you find out a learner really knows what he or she but is difficult to communicate. Verbal and non-verbal communication will cover more learners”.*

Participant 5 - *“I will show them my interest in their project I will ask them questions and how is it efficient that particular project how it is going to be used, then is when learners will open up and tell me more and communicate more about whatever and I will be able to know what enhance or prompt the idea of designing that particular project”.*

Participant 6 - *“You ask the learners a platform to go and research on how to design and ask for other people the learners come with information. When they come back, they tell how they get the information”.*

Participant 3 - *“Expecting everyone to know basics of English, encouraging learners in verbal or non-verbal communication, since some learners are good in non-verbal communication”.*

4.2.3 Exploration phase

In this theme, the researcher asked the teachers *“How do you introduce new concept to learners when facilitating Investigation, design, making and evaluation stages?”*. The response below shows how each teacher responded based on the following categories:

4.2.3.1 Investigation stage

When looking at how the teachers introduce a new concept to the learners when facilitating the investigation stage, the data revealed that 4/10 teachers indicated that they are capable of introducing a new concept to the learners when facilitating the investigation. The data indicated that the teachers provide the learners with material and ask questions. They indicated that they introduce the concept to find out what they know about the particular concept and clarify their misconception. For instance:

Participant 1 - *“Topics are related from grade 7 to grade where I can find plastics, what can I do with plastics. From there I will introduce recycling without telling them the answers they come with ideas, I just come with Technology terminology”*.

Participant 2 - *“When you bring new information you start with learners with what they know and you develop to something that is strange to them , what I refer as complex, but for you to do that make sure that when you start with what learners know it must guide them to what they don’t know in other words anytime you show them things that are a little bit visible or touchable until you arrive at things that are a little bit complex. So, what will you do you bring information starting from the one which is known so that it must meet to the one that is not known?”*

Participant 5 - *“A learner doesn’t come to class empty already when the learner come to class will be knowing something in every concept. I will be giving them the floor first with the question introducing the concept trying to find out what they know about that particular concept that’s when I will be able to investigate what information they have. If ever the information lacks are when that when we introduce the investigation, go, and find more about this”*.

Participant 9 - *“First of all in investigation we know that there is a lot of information which is needed and then that information it will tell the learners to understand what*

kind of project is going to be taught in the class. Then I am going to let them to come up with anything they are going to think about as a project. As for investigation that's where I will give them a choice to research to get information about the concept as an introduction so later, I can also clarify their misconception. They will learn by their first product".

However, 6/10 teachers were not able to introduce a new concept when facilitating the investigation stage. For example:

Participant 10 - *"I use different methods of teaching".*

Participant 3 - *"By using different methods".*

Participant 4 - *"sometimes I will start with something that is related e.g., a bridge in Shongoane".*

Participant 6 - *"You remind the learners on what they already know, you relate the new concept on what they already know to make them interest. Take the learners on what they know to what they don't know".*

Participant 7 - *"By relating what is within the school environment and outside, then there should be an investigative question, we need to make sure that the investigative question is put in such a way that what is in the school environment that learners themselves will relate it".*

Participant 8 - *"I will be careful on this, I don't believe my learners to know nothing I will find out what they know then I will extend their knowledge to what I want them to know".*

4.2.3.2 Design stage

When looking at how the teachers introduce a new concept to the learners when facilitating the design stage, the data revealed that 8/10 teachers indicated that they are capable of introducing a new topic to the learners when facilitating the design stage. The data indicated that the teachers use drawings and measurements to show the learners how to use the drawing instruments and they use the checklist to compile a list of tools. For instance:

Respondent 1 - *“Is drawing and Technology is not fine art which mean Technology you must measure what object are you doing , I always tell them in Technology when you draw you measure and I tell them to come with rulers, pencils and rubbers when they come tomorrow then ask them to draw a box then I check and instruct them to use ruler to draw and measure to make them understand technical drawing”.*

Respondent 2 - *“When we talk about the design the learners might start by drawing a room or measure a classroom then tell them to make four rooms of similar sizes so by so doing the information will be going complex”.*

Respondent 3 - *“Objective been to construct, I draft a guide to assist and make a checklist to identify the items to be used”.*

Respondent 5 - *“Normally I come with a picture or something related to the concept to show them what we are talking about and from there since it is a new concept I will be introducing a new concept, if ever I bring a picture of a bridge I ask them what do you see in this picture they will be able to tell me what do they see and since I will be imposing designing in that manner I will ask them have you ever imagining yourself designing any bridge draw that bridge and immediately they start drawing that bridge I will engage them in measurements and everything and that’s when they will be doing a new design in that bridge”.*

Respondent 7 - *“Designing in most cases is all about drawing. As I introduce the new concept is all about the technique that I introduce, can you actually how to hold a pencil, do you actually know how to hold a ruler. As long you know how to hold a pencil and a ruler then you can draw any thing”.*

Respondent 8 - *“I will ask them what they know about to design then I will let them to design, I can say design what I want them to make. Then I will ask them based on that”.*

Respondent 9 - *“In this stage, that’s where we generate possible solutions to the problem and then that’s where I will let them to formulate, to describe the new concept to state it the way they understand actually myself I will give them a choice first before*

I get myself involved in this and then from there that's why we talk about the adherence of specifications of the design".

Respondent 10 - *"The objective is to construct. I will draft a diagram and make a checklist and identify the terms to be used, this can be used even in future and if you design it be reduced difficulties when I do it for the second time it will be easy".*

However, 2/10 teachers did not introduce a new concept to the learners when facilitating the design stage for example some teachers were not able to introduce the concept to the learners.

Respondent 4 - *"I will talk about business of a plan and explain further".*

Respondent 6 - *"Is about relating, how do we design they must have an idea on what is expected of them. They tell their ideas".*

4.2.3.3 Making stage

When looking at how the teachers introduce a new concept to the learners when facilitating the making stage, the data revealed that 4/10 teachers indicated that they are capable of introducing a new concept to the learners when facilitating the making stage. The study indicated that the teachers introduce the measurements and using tools as well as the cutting methods. For instance:

Participant 1 - *"In making if I want them to do a box I come with a box and ask them what it is, then they will use the box to make their own box. I will then introduce measurement in making stage".*

Participant 3 - *"Construct items that have been designed before by making sure the design is in order".*

Participant 5 - *"I believe that there is nothing we can say is new we rather say things have been upgraded. I can come with an old-fashioned model object and say to them here we are having a trolley, but you can see that for a person to use it require more energy. So, it cannot be easily used, how can you improve this trolley a make the one that can be easily used, that's when they can be able to make something which is from their concept that is new".*

Participant 6 - *“Teaching them of different type of tools, you now introduce them to use the tools. Then again you notice them how safely to handle ones they have knowledge how to handle the particular tool. If they are making you teach them how to make measurements now”.*

However, 6/10 teachers were not able to introduce a new concept when facilitating the making stage. For example:

Participant 8 - *“I will use the same strategy as design, I will ask them to make a project based on the design then I will be guiding them along the way as they build the object until I let them to the new concept, I want them to go”.*

Participant 9 - *“On the making stage I test it many times, we talk about whatever we imagine the project but by that time that’s where we are applying the different types of manufacturing processes and that may also involve on cutting, joining, shaping, assembling, and finishing. So, I will actually let them cut and join whatever. I will actually ask them what is that they understand about the cutting method and the manufacturing processes in this making of the model from there they will try to understand what the idea was behind whatever I was teaching them”.*

Participant 10 - *“I will construct items that are designed before by making sure the design is makeable”.*

Participant 4 - *“I will show them photos and show them how it works and then go further and define it. I show them the practical one the previous one and the sketch”.*

Participant 7 - *“Making is all about ensuring the design is turned into the actual thing, is to ensure as a teacher carry a certain project, the making is the final project not in paper”.*

4.2.3.4 Evaluation stage

When looking at how the teachers introduce a new concept to the learners when facilitating the evaluation stage, the data revealed that 5/10 teachers indicated that they were capable of introducing a new concept to the learners when facilitating the evaluation stage. The data indicated that they test the project using rubrics, that is if it withstands the load and or if it squashes when put down. For instance:

Respondent 4 - *“I will show them a checklist and explain what is expected”.*

Respondent 5 - *“Since evaluation I will be testing, I prefer self-evaluation, I will give them rubrics so that they can better their project to suit the new project they will be dealing with. Therefore, after evaluation they can be able to upgrade”.*

Respondent 6 - *“Monitoring, I will monitor them on what they are doing. What you are doing you were not supposed to do this. Some of the learners when you gave them a project to do and is time for submission and when they bring it and put it down it squashes, and you may tell them they use wrong tools to make the product”.*

Respondent 7 - *“The learners need to know that conclusion is important, if you evaluate you need to know is my product in good condition is it strong does it actually withstand, everything that is made in technology it is meant to solve a particular problem. is all about comparing, trying to improve our lives, and solving problems we encounter every day”.*

Respondent 9 - *“We need actually a serious supervision that’s where we raise all the changes, in facts that’s the testing stage of the design. Because is the end of the manufacturing process. so, at the end of the manufacturing process, that’s where we do the supervision of whatever we have been made on stage 3, if ever it was not made accordingly, I will tell my learners will turn to make some changes even myself and then from there I execute the concept that was behind this process. they will actually understand its meaning”.*

However, some of the teachers seem not to be able to introduce a new concept when facilitating the evaluation stage, for example the teachers indicated that evaluation is about cost and indicating that the product must be eye catching.

Respondent 10 said that, in the evaluation stage, *“Here I will use it as final product since the designing and construction the learners will be advised that the product will be eye catching must attract the people, whatever they are presenting it must attract so that the next people can have more interest in whatever they are designing so that one has more interest”.*

Respondent 1 - *“Evaluation is about costing, whatever you do you must know how much it cost, if it’s a paper they must know how much it cost”.*

Respondent 8 - *“I will just have to draw to say if this is what you know about evaluation what about this, what do you think about this way of evaluating and then they will respond and from their response I will say let evaluate the activities as they evaluate, I will check them, I will moderate them and show them how to evaluate”.*

Respondent 3 - *“We will be looking at the final product since it went through designing and construction, the learners have to be advised that the product must be eye catching”.*

4.2.4 Enlightening phase

In this theme, the researcher asked the teachers, *“How do you relate different concepts to the topic when you facilitate investigation, design, making and evaluation stages?”*. The responses below show how each teacher responded based on the following categories.

4.2.4.1 Investigation stage

When looking at how the teachers relate different concepts to the topic when facilitating the investigation stage, the data revealed that 6/10 teachers indicated that they were capable of relating different concepts to the topic when facilitating investigation. The data indicated that the teachers compare different topics in whatever the learners are doing. For instance:

Respondent 1 - *“In terms of pulleys and gears, I will make them to understand when they have a circle and a rope around it as a pulley and when they introduce teeth around it become gears and in gears, we don’t use ropes”.*

Respondent 2 - *“This is where we talk about comparison, this is where we compare different things like for an example this is stage of exploring your descent new information as you compare it with the information that is known”.*

Respondent 3 - *“You try to link different topics; whatever learners is doing in order subject they must link in order subjects. e.g., since technology is related to natural sciences on circuits”.*

Respondent 7 - *“Take the learners out just to observe, e.g., hydraulics is better to move outside and allow them to observe what actually happening, so that when they come from out school environment and when they come to class they will understand”.*

Respondent 8 - *“It mean I must bring the other knowledge from the other discipline to relate it to technology discipline in terms of investigation, and I will say in this case when facilitating investigation I will say maybe taking an example from maths when they are given an investigation to go and complete, I am going to say go and relate your maths investigation and when you investigate what did you do? They will say I will go and check in the books read consult the internet, consult other teachers and student teachers and so on, and I will say and even this one you can consult the internet, books, and student teachers but in discipline of technology”.*

Respondent 9 - *“If we have two different concepts and I want to introduce them or relate them to the learners but on the stage of investigation, we know that I have to give the learners a choice or a chance to learn on their own space. From there myself I make them to understand what that is written maybe I am writing a word on a board which is maybe evaluation in a design process and the other word at the other side making in the design process I will make them to understand the first part and the second part separately. from there that’s why they have to take the relation because you might find that there is a certain point which is similar to the other concept that is why we have to access learners on concept because they may turn to see this content is singular to this content and from there, they will see the similarity they will see the relation”.*

However, 4/10 teachers were not able to relate the different concepts to the topic when facilitating the investigation stage for example the teachers indicated that they tell the learners what they already know, for example when they give the learners homework, they tell them to investigate what is expected.

Respondent 10 - *“I will try to link different topics whatever the learners is doing in any subject they must link the subject in order for example whatever technology is linked to natural science in circuits”.*

Respondent 4 - *“I will explain the differences of terms”.*

Respondent 5 - *“We normally say in technology a force is push or a pull. But in each and every bridge, a bridge will experience different type of forces.in investigation I will like my learners to find out on their own the relationship between forces andbridges”.*

Respondent 6 - *“You have to tell them what they already know for example if you give them homework to design you tell them to investigate and what is expected of them. When you are investigating you use wood, and they have to investigate whatever they like”.*

4.2.4.2 Design stage

When looking at how the teachers relate the different concepts to the topic when facilitating the design stage, the data revealed that 4/10 teachers indicated that they are capable of relating the different concept to the topic when facilitating the design stage. The data indicated that the teachers compare the different sketches as well as the shapes and shows them as examples where the learners will practically draw them and relate them to any project when designing a house, a stadium or any project considering the measurements in advance. For instance:

Respondent 3 - *“Link different topic in designing e.g., when you want to design a cell phone and, in the phone, there are different component that are found in natural sciences since there is a switch, a battery and I will link the knowledge”.*

Respondent 4 - *“I will compare different sketches; different shapes show them the examples and show the practically and draw them”.*

Respondent 6 - *“When designing you have to give learners examples, before they do this room, they have to do measurements. Before you go to making you must have measurements”.*

Respondent 7 - *“Since an everyday we experience new things, when we ensure that learners become more hands on when they become hands on, they can actually saw or came across with the topic that they are busy with in the classroom, it mostly become hand in with”.*

However, 6/10 teachers were not able to relate the different concepts to the topic when facilitating the design stage. For example:

Respondent 8 - *“In this case I will relate topics to design, I will then say but I will say is in the same discipline I will then say think about architecture, when designing any project it can be a mall, a house, stadium and whatever project they may design and think about what should be done what should they do, they brainstorm they come up with ideas they do different solutions and then at the end of the day they have reach one solution that is satisfactory and that satisfy the specification”.*

Respondent 9 - *“Since when I gave them the research to understand this two different concepts maybe I divided them into groups now that where they have to come together they actually compare everything that they understood then sometimes if for instance I took two groups this two groups the other group they are defining a certain concept and this other group they are defining a similar concept to compare I will them to have debate due to their relation to this two concepts. I will draw up a conclusion so that there will be an effective or a possible solution for that certain statement on relating the two concepts because the learners they will turn to brainstorm they will think deeply critically and analyse whatever they think is right for them”.*

Respondent 10 - *“I will link different topic in design let me give you an example, when you want to design a cell phone in the phone there is different components that are found in natural sciences since they teach the battery, I will link the knowledge”.*

Respondent 1 - *“In design is when learns draw circles and learners can make desks but because they don't have material they can't and became a challenge”.*

Respondent 2 - *“Every time learners will know that we have design this simple artifact then you bring another artifact which might have almost similar futures but in different ways so that they must not be stuck, they must go from where they know until they arrive where you want to lead them”.*

4.2.4.3 Making stage

When looking at how the teachers relate different concepts to the topic when facilitating the making stage, the data revealed that 7/10 teachers were able to relate different concepts to the topic when facilitating the making stage. The data indicated that the teachers gave examples and do hands on activities asking the learners questions and showing them how to take measurements. For instance:

Respondent 1 - *“The concept if for learners to know that technology whatever topic we desal with we should make an idea to make a product”. The teacher further emphasised by saying, “learners have creative minds if materials are available, it become a challenge when material is not available”.*

Respondent 3 - *“In making there is different topics I will give an example about a car, mechanical energy, electrical energy as well as electricity is there, we just combine all information that we have to get a final product. So, when we make a car, all technicians must be there”.*

Respondent 5 - *“You will find that people are having the same product nature and of the same use. For example, when they use towers, they use triangles and in some they will not use triangles so it means that now they will be going back to the concept of shapes how strong those shapes are, if I use a circle will it be strong as I use a triangle. That will be linking the two topics the shape there will be a making in that concept”.*

Respondent 6 - *“You take learners to the outside world, taking them outside and show them how to take measurement in reality in projects. What every they see what you told them in class they will realise that they are real”.*

Respondent 7 - *“As making is the final product, I mostly see learners drive wire cars, if we are at the topic on car manufacturing, they will know what makes the car to left and right then since they were able in their childhood ages then they will be able to use the information from childhood and in that particular moment”.*

Respondent 8 - *“I will just say to them in making we can look at any discipline where they have to make an object where they have to practicalize the object or activity in technology discipline. In this case we are going to have hands on where they I will be doing practical”.*

Respondent 10 - *“In making stage there is different topic let say about a car mechanical energy, electrical energy let say electricity we just combine the whole information to bring about the final product let say when designing a car all technicians,*

remember I say in designing a car different technicians will be needed. There will be different technicians, I will be combining the whole information”.

However, 3/10 teachers were not able to relate the different concepts to the topic when facilitating the making stage. For example:

Respondent 9 - *“On the making stage that’s where I found to be that if we have two groups of learners and now they come together on relation of those two concepts they have the similarity at some point but at some point they have some constrains there is where this concepts cannot be similar but somewhere it can be similar so de debate is more important during the lesson where ever you are making a certain model so that the model will also have that looking, the looking of the model will be authentic”.*

Respondent 4 - *“I can tell them to design a bride and they will relate the bridges”.*

4.2.4.4 Evaluation stage

When looking at how the teachers relate the different concepts to the topic when facilitating the making stage, the data revealed that 4/10 teachers indicated that they were able to relate the different concepts to the topic when facilitating the making stage. The data indicated that the teachers focused on the outcome of the product if it is functioning well, and they checked the product’s weaknesses and the strengths. For instance:

Respondent 3 - *“We will be focusing on the outcomes then on those outcomes, we look at all steps we went through, the product must be maximum functioning well”.*

Respondent 5 - *“The topics are related there will be the that will be introduced first meaning the second will be relying on the first one. In that manner the second will have all the requirements of the first topic in other words we are upgrading. In order for me to facilitate evaluation I think from the rubrics that we are having I will give them reference telling them from the previous on what we were having now we are doing this”.*

Respondent 7 - *“Is all about checking the weakness and the strongest points. Is all about observation you encounter every day. In food processing I know that food can rot but when it comes to classroom is when I get full information when it comes to*

classroom, I saw food rotten now what cause food to be rotten. I will be questioning myself why this happens”.

Respondent 9 - *“Since when we are at evaluation, there is a point where we have to test the relations of those two concepts, so that’s where we have to ask the learners, why do you think the concept have a relationship with this and then from those questions that’s where the learners will start to see the relation of the concepts, because many questions that you as the learners they don’t understand them but if you take the question back to them that’s when they generate their own answer based on the question they asked from them”.*

However, 6/10 teachers were not able to relate the different concept to the topic when facilitating the evaluation stage. For example:

Respondent 10 - *“We will be focusing on the outcome, we will be focusing on the steps that we went through then the end product must be functioning well, since we will be having different steps to ensure that the product is functioning well”.*

Respondent 1 - *“I will ask the learners the cost of the material they will guess but they will you know how much it cost when they made it. The concept is for learners to know the design process and how to ensure from the problem to the solution”.*

Respondent 2 - *“When they evaluate, they must be in the position to evaluate whatever they have done so that the new information must always be kept there”.*

Respondent 6 - *“Is the same thing when I will be taking learners outside the classroom. And show them how do workers evaluate. Then I will also come to them that once you have designed does it work accordingly by checking if it suit the need, since you will be checking for example when you designed a truck you designed it with round wheels and you made square wheels and the truck is not moving you will be going back to the design and check then you will make a round wheeled truck then it will be moving”.*

Respondent 4 - *“I will start by number one asking them do you have a wire, do you have a glue, I will differentiate between question number one and number two and explain it this one is different from this because of this and this”.*

Respondent 8 - *“I will just say how do you evaluate you peer work, in technology if there was a project that was done there should be evaluation part where the inspectors come to evaluate the building or the project, I will say to them in this case you are going to evaluate”.*

4.2.5 Elaboration phase

As indicated in chapter 2, the elaboration phase teachers looked at how the teacher relates real-life experiences to the new concept within the classroom context. To understand the teachers' ability to relate real-life experience within the classroom context, the researcher looked at two questions. Question 1 was *“How do you connect everyday experience with the topic when facilitating the investigation, design, making and the evaluation stages?”* Question 2 was *“How do you support learners to use tools, build and test the product when facilitating the design, making and the evaluation stages”.* The question further required the teachers to elaborate. The sections below show how the teachers responded based on the following categories:

4.2.5.1 Investigation stage

When looking at how the teachers connect everyday experiences with the topic when facilitating the making stage, the data revealed that 6/10 teachers indicated that they were capable of connecting everyday life with the topic when facilitating the investigation stage. The data indicated that the teachers were capable of collecting information and advising the learners when they start a topic and link real life with the topic with examples. For instance:

Respondent 1 - *“Since technology is about problem solving, I will ask learners to look around and identify the problem that we have they will then relate the problem and to solve it”.*

Respondent 2 - *“When collect information you need to advice the learners, when you start every topic advice by advising it will mean that the information that is known to them must further go to the information that is not known. That is what I said you go from known to unknown and by so doing it will be unlocking the children’s minds in order to move towards complex activities. So, you must always connect previous lesson with the new lesson as it becomes a continuation, and the learners mind will not have a gap will always continue in that particular fashion”.*

Respondent 3 - *“The universe evolves around technology. We link the life that we are living now with technology. When you construct your product must be technological advance”.*

Respondent 5 - *“Technology is more understandable when you are giving examples about real situation. The reason been it helps learners to be more interested in improving their real-life situation to solve most problems. When facilitating my learners on investigation I use topics that are related to them for example when we are dealing on concept of bridges, around here they were experiencing problem in rainy days. I asked them what a bridge is they kept quiet, and I asked them further what we use bridge for they use it to cross the bridge when it is raining. Then I said you will need a bridge in rainy days. Then I asked them which bridge will be suitable a lengthy stream and from the tyre road and what type of a bridge is that one. That was part of my investigation”.*

Respondent 6 - *“The first thing you will need to tell the learners that we are surrounded by technology everything we do is technology, even at home the furniture is technology. For example, when I take a topic on structures you teach them about structures, then you teach them on different type of structures then by telling them you will be even telling them eve the desk you are sitting on belong to the topic even itself is a structure so that they have that knowledge”.*

Respondent 9 - *“Since we know that the experience actually is something acquired or accumulated or attained by senses it can be by touching by seeing something which is real. So, in investigation you will have to give learners chance to go out observe and gather certain information by themselves generating information that is going to be needed by their design process in technology, because this is the first step important for them to acquire that experience. Allow them to research but on the research, they must research through objects because it is more effect whenever the learners, they are researching the learning will be effective because it is something that they can touch, and they can see. That is the way they have a certain experience”.*

However, 4/10 teachers were not able to connect the everyday experience with the topic when facilitating the investigation stage. For example:

Respondent 10 - *“The universe evolves around technology the type of life we live involve technology, when you construct your product, it must be technological attached. You can see now covid-19 even though it has its pandemic negative impact it pushes us to focused on technology, so whatever we are doing now it must be technological advanced”.*

Respondent 4 - *“I explain all, always when I start a new topic, I will ask them about the previous topic normally when I give them topic, I mark it and focus on what they fail all”.*

Respondent 7 - *“Is about the demonstration, I will be demonstrating to the learners how to handle the tools. Is all about guiding them about the do and the dents”.*

Respondent 8 - *“I will say I will give them an example and say if your parents want to buy a car or a house you will do investigation that this car have how many doors, how many people will it accommodate, and which fuel will it use. Is all about finding the facts what are you going to do”.*

4.2.5.2 Design stage

When looking at how the teachers connect everyday experience with the topic when facilitating the design stage, the data revealed that 4/10 teachers indicated that they are capable of connecting everyday experience with the topic when facilitating the design stage. The data indicated that the teachers encourage the learners to be hands on by drawings. For instance:

Respondent 2 - *“Learners cannot do anything unless there is a facilitator, every time you give them a project you will need to have an idea of what it is. If a learner is unable to draw a product it means the teacher has failed, so you are a facilitator in all aspect you are the one who need to advice where to go and that will be fine for them”.*

Respondent 6 - *“Giving an example to show them practically, they must have whatever they have in mind they must have to design first. Then I will tell them to go to their homes and check the room and drawing it down”.*

Respondent 7 - *“Since every day we experience new things, is when we ensure learners become more hands on. In most cases it goes hand in hand with what they are experiences daily”.*

Respondent 8 - *“I will say to them let’s think of real situation, an architecture, and a client where the client think of this is the kind of the house, they want it should so many bedrooms. And that the part of design. The client gives the architecture the rough sketch of the design. Meaning everything we do in technology we must have design; they must have different types of design. From there we are going to choose and implement the chosen one”.*

However, 6/10 teachers were not able to connect the everyday experiences with the topic when facilitating the design stage. For example:

Respondent 9 - *“That’s where they will teach best ideas themselves, if they are designing something maybe a model, they will have to actually check what is the best for this object they will actually involve or consider the environmental impact, since we are talking about something that is concrete something that is not abstract, so they will also check the safety. Because we are talking about the experience and then their health throughout that design process and it is very much important. And they will have to know the purpose of why they are designing and why are they generating possible solution of that problem and that is how they will acquire that experience”.*

Respondent 10 - *“I will be facing the challenge, the design when we are doing the design, we are including the competition as well, since the competition is very high. Now the competition is very high of now whatever we are designing we must think of the competitors as well. You must include the marketing as well. We design on the need of the people”.*

Respondent 1 - *“If I want to use a gear the number of teeth determines the capacity meaning the number of teeth determines how fast the bicycles is moving, the number of teeth on the driver and the number of teeth on the driven”.*

Respondent 3 - *“Will be facing the challenge where competition is very high then the design must favour the product, so when we are doing de design, we must look at the competition. In our design we must put competition in place”.*

Respondent 4 - *“When we talk about the plan, the plan is related to electricity. I will draw a plan I will use an electricity inside a plan”.*

Respondent 5 - *“I normally say, are you satisfied with that bridge you are having there some will say, and some will say no. I will then ask them which aspect you think of changing it means it will require a learner to design a bridge based on what they are experiencing there everything they which to change on that bridge. That’s where they will require to design”.*

4.2.5.3 Making stage

When looking at how the teachers connect everyday experience with the topic when facilitating the making stage, the data revealed that 5/10 teachers indicated that they are capable of connecting everyday experience with the topic when facilitating the making stage. The data indicated that the teachers describe the material and the use of proper tools and safety precautions. For instance:

Respondent 4 - *“If I use a house plan the making the house, they use the wire after that I electrify the house”.*

Respondent 5 - *“I usually tell my learners whatever u design and make need to be unique in order to own that idea. When facilitating the making part, I always make sure that the idea they are having they are trying to better it relating to the real situation”.*

Respondent 7 - *“Is a final product. In most cases they drive wire cars when they turn when they turn the steering wheel. They can use the knowledge from child wood and bring it to the classroom”.*

Respondent 9 - *“This is the doing part of the process, this is the very easy process. because we involve different manufacture processes that’s where we take some pictures make some evidence, record like most of the experiment is taking place, the description of certain material and we also have to use appropriate and proper tools for the model. And we have to tell them to work accurately and safely. So that’s were*

more of the learners have to adhere on the safety of the equipment and they will be wearing whatever is needed for their safety and requiring or considering the quality”.

Respondent 10 - *“Let me go back in the design whatever we made in the design we check that does it worth the current situation, if it does not worth the current situation we go back to the design and engage the type of design we want to design. And we redesign. If we go back and redesign the waste of time money and energy and you redesign what you should have been avoided before, if we did things right in dev design there is no need to redesign. If we miss the marketing point, we should avoid the redesigning process. example the Toyota company is competing with other companies it tried with its vehicles to be technological advanced it is very important to research before you design to avoid redesigning”.*

However, **5/10** teachers were not able to connect everyday experience with the topic when facilitating the making stage. For example:

Respondent 1 - *“The making is the production stage how do u produce it”.*

Respondent 3 - *“We will be going back in the design whatever we wanted in the design we check does it worth the current situation, if it doesn’t worth the current situation then we must go back to the design to re design the item. In order to make a valuable we must engage the type of design we designed”.*

Respondent 6 - *“If the topic is structures, learners know that we have structures, and everything is a structure you tell them that we are sounded by structures they have to be expose themselves on structures. To relate is whereby you teach them on what they know and what they see it will be easy for them to learn, you take them from what they know and see every day and relate it with the topic you are teaching”.*

Respondent 8 - *“I will say let’s look at the technological workshops where the objects are made, they will see that there are plans for the object that have been made for instance if they are going to mechanical workshop where maybe they pack or they build the engine they will see the plan of that engine, how is that engine designed and how it should be. Meaning when they are making meaning they should use their hands-on method”.*

4.2.5.4 Evaluation stage

When looking at how the teachers connect everyday experiences with the topic when facilitating the evaluation stage, the data revealed that 5/10 teachers were able to connect everyday experiences with the topic when facilitating the evaluation stage. The data indicated that the teachers were comparing and identifying the strengths and the weaknesses of the product, evaluating materials, and identifying errors. For example:

Respondent 3 - *“We go to what we have constructed, when we say it is ready to be used, we evaluate when we test, we find it is not ready then we reconstruct.eg when we test the bridge after evaluating the bridge, we identify the errors whether the bridge caters the needs of pedestrians and motorists if it does not, we reconstruct”.*

Respondent 5 - *“I ask my learners to compare. Looking at the bridge that you are having it is better than that one you are crossing every day, if it is not better meaning it will perform worse than the one you are crossing. So, they will make something better. Then they will come up with disadvantages. In evaluation they are required to compare the old one with the new one improvement that they are making”.*

Respondent 6 - *“Firstly whenever you are teaching a topic you give them classwork and homework then you check the level of understanding of the learner”.*

Respondent 7 - *“All bout checking the weakness and the strong points. Is all about observation encountered every day, as onside the school environment we know that food can rot. When I come to classroom, we start evaluating what I saw and trying to know why and what causes what actually happen”.*

Respondent 10 - *“In evaluation we go through what we have constructed, when we say it is ready to be used, we evaluate when we test it and when it not ready, we then reconstruct for example when we test a bridge, we identify the errors whether the bridge is able to carry pedestrians, motorists if it does not, we reconstruct”.*

However, 5/10 teachers were not able to connect the everyday experiences with the topic when facilitating the evaluation stage. For example:

Respondent 1 - *“I always make sure that I explain to learners that when always they go to the mall they use a taxi, but if they use a bicycle they will gain in form of exercising and cost effective when they ride a bicycle around home rather than going to the gym”.*

Respondent 4 - *“When I go through the checklist by relating the practical and theory”.*

Respondent 8 - *“I will say look when you are going to buy a shirt in the shop you are going there and wear the shirt in the fitting room then your friend is evaluating. If the object is in line with the investigation”.*

Respondent 9 - *“Since we know that we are improving the productivity of the model or the product in the technological design process. that’s where learners they have to highlight each other, by saying this is right this part, this part must be ninety degrees, and this must be parallel, and this part must be increased by 2m. That’s where they raise critical questions, individually or some other learners they can ask as theoretical questions but later on they can execute them out and from there the object or the model will be fairly tested and also be fair for everyone”.*

In this theme, the researcher further asked the teachers *“How you support learners’ to use tools, build and testing the product when facilitating design, making and evaluation stages?”.*

The response below shows how each teacher responded based on the following categories:

4.2.5.4.1 *Design stage*

When looking at how the teachers support the learners to use, build and test the product when facilitating the designing stage, the data revealed that 8/10 teachers were capable of supporting the learners to use the tools, build and test the product. The data indicated that the teachers make sure that they have all the equipment readily available. For instance:

Respondent 1 - *“We just use ruler, pencil when tools are not enough, they share since they will be measuring, every learner should have pencils and rulers when they come to class”.*

Respondent 3 - *“In experiments there is practical work, so we expect the school, the government or private sector that particular sector must have all equipment so that we can carry all experiments because without equipment we cannot carry experiment. We must support learners to carry experiment provided we have equipment in place. If we want the learner to perform in that particular practical, we might find the situation whereby the school doesn’t have the resources. the educators will be suffering. The learners should have all equipment”.*

Respondent 4 - *“Encourage the learners in taking carriers”.*

Respondent 5 - *“I normally tell them to use the right tool for the right job because if you misuse your tools, you will do more mistakes. If ever they are required to use a ruler, they have to use it because they will be sure about the measurement, they can’t just assume that this is one meter without using a ruler. I normally support them that if u use the right material for the right job there is no way you can get wrong”.*

Respondent 7 - *“I am going to demonstrate, to the learners how to use tools there are certain tools which are dangerous. Is all about guiding them. And all about handling the tools. Even in terms of building just tell them about the do and the dons, even testing to test whether it is strong, or it is not”.*

Respondent 8 - *“There should be technological tools when designing, if they do manually if they are not doing it manually there should be a computer software in order to design successfully”.*

Respondent 9 - *“Learners in the most cases they need full supervision whenever they use tool because tools they are mostly dangerous and they need someone who is careful and who is wearing everything that is required for instance if the learners are working with acid they will need to wear safety goggles and gloves and they need to wash their hands and lap coats or working clothes on, in the designing they have to work in clothes because they will be instructed ”.*

Respondent 10 - *“In experiment the practical work we expect the government to provide with equipment, without any equipment learners will not be able to perform any experiment. So, we must support the learners to perform experiment if we want*

our learners to perform practical, we must have equipment. When I did my research this multiracial schools' learners have equipment. Is bad for learners to learn theory without practical".

However, 2/10 teachers were not able to support the learners to use, build and test the product when facilitating the designing stage. For example:

4.2.5.4.2 *Making stage*

When looking at how the teachers support the learners to use, build and test the product when facilitating the making stage, the data revealed that 9/10 teachers were capable of supporting the learners to use, build and test the product when facilitating the making stage. The data indicated that the teachers consider the safety of the learners when using the tools and it ensures that all the resources are available.

Respondent 2 - *"This is a dangerous part, safety first when we talk about learners with tools, we must show them all the warning signs how dangerous tools are and learners have not to go to tools in isolation always the facilitator must be there. before".*

Respondent 3 - *"When learners want to construct a bridge learners should have all resources, we must have a checklist to verify if we have all resources. if an item is missing, we must make a point that we have it in place then you can construct your item".*

Respondent 4 - *"-Encourage them to use tools and encouraging them to like practical".*

Respondent 5 - *"I usually tell them that before using a particular material or a particular tool make sure that you know how is supposed to be used and where and it is suitable to make that particular project because if it is not suitable for that project it will break there will be a failure in that particular project. I always support them to use the material of quality and also to know the properties of different materials so that they will be make something that can last longer".*

Respondent 6 - *"By teaching them the safety first, by teaching them how to use the tool and how to handle the tools and even how to handle tools".*

Respondent 7 - *“Is ensuring that is indicated in the design you must be considerate of the tools and material”.*

Respondent 8 - *“It must be done in the workshop where learners must use all the tools in the workshop, the schools should actually all have technology workshops where technology learners are supposed to do the practical there to practicalize the theory that they have learned in class with hands on method”.*

Respondent 9 - *“We involve manufacturing processes because this technological design process it falls under manufacturing and then manufacturing a manufacture will be able to use the skills and knowledge required. The point is where we are manufacturing one learner, or one person cannot cut and going to join and paint. We have to split them so that others can use grinders and we don’t have to overload a certain equipment to a certain person or a learner we have to group them together so that they will be able to make authentic product that’s where we have to come up with appropriate materials and tools to be used and it with work accurately if it is functioning accurately. Because firstly in the first stage when we were supporting them on the investigation through using tools there is a lot of description is an instruction how to use a grinder now, they are cutting using the grinder now is where the experience count, they will not experience difficulties”.*

Respondent 10 - *“When a learner constructs a bridge learner should have resources, we must have a checklist to verify if we have all the resources, if the item is missing, we must have a point that that is in place so that we can construct a project this will also help the learners in project management, learners will also have skills in project management. So, in the making stage you must have a list, and, in this list, there should be also the cost. My learners I will assist them that they must try to balance that in future we avoid this project that are lying around when they fix the road, this is the lack of project management”.*

However, one teacher was not able to support the learners to use, build and test the product when facilitating the making stage.

Respondent 1 - *"I use what I have, if I have boxes, the boxes that are used to carry books instead of burning them I keep them we use them to build model. And learners stick on time for time management".*

Evaluate stage

When looking at how the teachers support the learners to use, build and test the product when facilitating the evaluation stage, the data revealed that 7/10 teachers were able to support the learners to use, build and test the product when facilitating the evaluation stage. The data indicated that the teachers support the learners by comparing and testing the strengths and the weakness of material.

Respondent 1 - *"The tools give learners ideas that we are using cardboard for curiosity's sake they will check them and find out if they make a desk what is needed to make a desk and how much does in needs".*

The teacher further emphasises by saying, *"Evaluation become difficult when they speak their mother tongue".*

Respondent 4 - *"I will support them by choosing the right material".*

Respondent 5 - *"They will have to compare they will have to compare that if at that point they use a paper what happens and if they use corrugated iron what happens. Then therefore they will choose the best and that's when they will evaluate this material is good for this job".*

Respondent 6 - *"To find out if it is working you test it before, to see if you used a right material you need to test it before, if the product collapse meaning learners use a wrong tool".*

Respondent 8 - *"We will be testing our final product if it is in line with whatever we designed".*

Respondent 9 - *"On evaluation that's where we have the actual product and on evaluation that's where we have to observe and modify and test the product. that's where we consider the specification, the parameters and quality if is not working properly, we modify the product or the model".*

Respondent 10 - *“There are equipment that they use to evaluate, whether the item work while or suit the current situation we must check that it may suit the evaluation”.*

However, 3/10 teachers were not able to support the learners to use, build and test the product when facilitating the evaluation stage. For example:

Respondent 7 - *“Testing the strength and he weakness, for example when they are asked to bolt the house I will test”.*

Respondent 2 - *“Make sure the learners wear protecting clothes before they touch tools, make sure they don’t taste chemicals. Warn the learners how dangerous are this chemicals. When we construct something that is bigger, they may not jump on top of it because they may not be strong enough so that it can hold them more especially when we go to complex things, they must not just test them before you are sure this have been evaluated and properly, they are user friendly”.*

Respondent 3 - *“There are equipment that are used to evaluate whether the item work while or suit the current situation we don’t evaluate by look or touch”.*

4.2.6 Evaluate phase

As indicated in Chapter 2, the evaluation phase looked at how the teacher determines the evidence of the learners’ learning by assessing them. To understand how the teachers determine the evidence of the learners learning, the researcher looked at two questions.

Question 1 - *“How do you evaluate the learners’ decision and problem-solving techniques when facilitating investigation, design, making and evaluation?”.* **Question 2** - *“How do you evaluate learners’ progress when facilitating Evaluation stage?”.* The question further requires the teachers to elaborate. The sections below show how the teachers responded based on the following categories:

4.2.6.1 Investigation stage

When looking at how the teachers evaluate the learners’ decision and problem-solving techniques when facilitating the investigation stage, the data revealed that 6/10 teachers were able to evaluate the learners’ decision and problem-solving techniques when facilitating the investigation stage. The data indicated that the teachers do not

limit the learners' information, as they come with different ideas. They also indicated that there is a need for a rubric to evaluate the learners process in the investigation and asking the learners the advantages and disadvantages of the product. For instance:

Respondent 5 - *"I believe that in technology every decision it need to be supported by reasons. If you saying I am decided to use this material, we will say why using that material, then it means you will go further and explain. Any we will ask the advantages and disadvantages. Then they will go further investigating the advantages and disadvantages. And also, will lead them to solve the problem they are having"*.

Respondent 6 - *"Firstly you don't limit learner's information you give them chance to come up with ideas, when they come with idea lets apply learners' ideas. Then see if it does work on not. Learners' ideas must not be limited"*.

Respondent 7 - *"It depends on what they phrase the investigative question, assessing the investigative question and learners are using the correct manner of collecting information"*.

Respondent 9 - *"Since here the learners and the teacher are different the information, I have will not be the same information they have the approach to the certain problem will not be the same as the approach as I will approach the problem. So, my evaluation here maybe I will be able to implement maybe a rubric which is having a certain kind of conclusion where maybe I needed a specification the appearance of the object, the quality, and the conclusion of their research"*.

Respondent 10 - *"I will encourage the learners to have problem-solving skills, I will teach them how to tangle all the challenges that are facing wherever they are having, if they lack problem solving skills, they will not be able to solve problems, you must investigate what is the source of the problem and try to solve the problem and avoid the problem to happen again"*.

However, 4/10 teachers were not able to evaluate the learners' decision and problem-solving technique when facilitating the investigation stage. For example:

Respondent 1 - *"Look around and solve the problem that you have identified"*.

Respondent 3 - *“You must encourage the learners to have problem solving skills”.*

Respondent 4 - *“I check and show them what to do”.*

Respondent 8 - *“I will see when learners took decision in investigation maybe the decide by taking pictures and I will say why do you take one type of picture, if they were investigating about arc, they should bring arc different ways. They will have to bring different positioning of arc”.*

4.2.6.2 Design stage

When looking at how the teachers evaluate the learners' decision and problem-solving techniques when facilitating the design stage, the data revealed that 5/10 teachers were able to evaluate the learners' decision and the problem-solving techniques when facilitating the design stage. The data indicated that the teachers were able to give the learners the drawing tools and evaluate them by using a rubric to evaluate. For instance:

Respondent 1 - *“When giving them pencils and rulers I will evaluate what they drawn, the first thing is to draw a box”.*

Respondent 2 - *“Rubric must be there to guide”.*

Respondent 7 - *“Checking if learners use correct deigning measures, if it is in two dimensions or three dimensions”.*

Respondent 9 - *“Here I will have to consider whatever they have designed because in this stage two they will have to explore ideas and they will also have to state the purpose and the function of whatever they will be designing. They will show it to me when they are design so that I will evaluate their drawings. I will make supervision when they did dimensions”.*

Respondent 8 - *“I will have evaluated if their decision, I will have to question their design by questioning their decisions by asking why they are putting it there”.*

However, 5/10 teachers were not able to evaluate the learners' decision and problem-solving techniques when facilitating the design stage. For example:

Respondent 10 - *“Some may find the right tool to solve the problem that the person may be going directly to the tool and fetch it up immediately, but some examine it first”.*

Respondent 3 - *“Some may find the right tool to solve the problem the person may be going directly to the tool and fetch it out and solve the problem immediately, but some examine it first”.*

Respondent 4 - *“I check and show them what to do”.*

Respondent 5 - *“A learner can’t just say I have this design without having reasons deciding using that design. Learners need to design something which is better but again it needs to solve that particular problem. when designing that particular object, I will evaluate based on the reason why are you designing that bridge, how will it help”.*

Respondent 6 - *“I give them the platform to design and check the design you ask the learner that this is you design and ask the learner what material will be use?”.*

4.2.6.3 Making stage

When looking at how the teachers evaluate the learner’s decision and problem-solving techniques when facilitating the making stage, the data revealed that 5/10 teachers were able to evaluate the learners’ decision and problem-solving techniques when facilitating the making stage. The data indicated that the teachers assessed and encouraged the learners using the right tools every time they solve a problem. For instance.

Respondent 2 - *“Rubric must be there to guide”.*

Respondent 7 - *“Is all about does you followed your design or drawing, if learners followed the design, then they followed the correct procedures”.*

Respondent 8 - *“I will have to interrogate and evaluate their decision where their object is not in line with what they designed then I have to ask how you move from this position to this one, why this one is not in correspondence with your designs”.*

Respondent 9 - *“We also have to look into whatever was specified in the design brief; I have to look whatever the learner was specified on the design brief. That’s where I will tell them which material should be change on their product”.*

Respondent 10 - *“I will encourage the learners to use tools every time when solving a particular problem let say when they in the design when you design something we go back to that example of the bridge when you try to build a bridge you don’t just build a bridge without bringing architect”.*

However, 5/10 teachers were not able to evaluate the learners’ decision and problem-solving techniques when facilitating the making stage. For example:

Respondent 1 - *“I will see where learners are trying to make and looking at the time, if time will be moving and learners are not progressing, I will see that learners don’t know what to do. Time frames have to be adhered to since they will be working on projects then time management is important”.*

Respondent 3 - *“I will encourage learners to use tools every time to solve a particular problem”.*

Respondent 4 - *“I check and show them what to do”.*

Respondent 5 - *“Immediately when you make something you think that there is a need for something to be made that means. So that means immediately when you decide that I am going to make this you will be trying to solve a particular problem. I will evaluate based on which problem where you trying to solve, then is the problem solved when you’re making this. If the problem is not solved, then the learner will go back to the drawing board and make the one that will solve the particular problem we are solving. That’s when the learner will decide that this project, I am making is suitable”.*

Respondent 6 -- *“What challenges will I experience when I will be making”.*

4.2.6.4 Evaluation stage

When looking at how the teachers evaluate the learner’s decision and problem-solving technique’s when facilitating the evaluation stage, the data revealed that 3/10 teachers were able to evaluate the learners’ decision and problem-solving techniques when facilitating the evaluation stage. The data indicated that the teachers use rubrics to test the product and improve t. For instance:

Respondent 2 - *“Rubric must be there to guide”.*

Respondent 7 - *“If the product does solve the problem by testing it. I the product withstand the problem meaning it meet the standard”.*

Respondent 9 - *“I will have to address where necessary to improve the product, and evaluate the criteria according to the design, that’s where I will be making changes there and there, since this is the end of manufacturing process”.*

However, 7/10 teachers were not able to evaluate the learners’ decision and problem-solving techniques when facilitating the evaluation stage. For example:

Respondent 10 - *“I will evaluate learners how learners use those tools I will evaluate how they apply those tools to solve those tools to solve that particular problem. if you don’t have that particular knowledge, you will find an expert in that area, I will encourage teamwork since learners will learn from each other”.*

Respondent 1 - *“Is about costing how much the cost, have to calculate”.*

Respondent 3 - *“I evaluate learners how learners are using those particular tools. I will be evaluating how they apply those tools in solving that particular problem”.*

Respondent 8 - *“I will have to say, why are you interrogating this aspect and why not interrogating the other aspect, learners will say, learners will account. Learners will come with reasons why they are arriving there”.*

In this theme, the researcher further asked the teachers, *“How do you evaluate the learners’ progress when facilitating evaluation stages?”.*

The response below shows how each teacher responded based on the following categories:

4.2.6.4.1 Evaluation stage

When looking at how the teachers evaluate the learners’ progress when facilitating the evaluation stage, the data revealed that 7/10 teachers were able to evaluate the learners’ progress when facilitating the evaluation stage. The data indicated that the

teachers assessed the criteria by using a rubric for summative and formative assessments to monitor the learners' progress. For instance:

Respondent 1 - *"I want to know their calculations whether they did calculations correctly, we bring maths into technology".*

Respondent 2 - *"Progress simple means whether this learners developing ideas, they have knowledge in other words by so doing you check the knowledge they are having because always I said you use this method called the known to unknown every time you start a new thing you need to touch the one you have already dealt with to realise whether they are good into that and they will respond positively if there is a progress you will find that they are developing their mind is opening up, so whatever they do you must always assess their progress in case you realise there is a back fall or you try to move from the know the one you think it is known and it has not known you need to reverse a little so that you bring them forth until you arrive where you want them to be and they must be able to cope with that particular aspect they must be in the position to answer those questions as you are checking their progress. Daily you must assess them for example you give them a rubric. The following day when you cum you must know their progress".*

Respondent 3 - *"Here I want to determine whether the learners understand the concept very well now I will be evaluating their progress whether they will go to the next level, so I will be using summative or formative assessment to monitor the progress of the learner's basement can also be in practical and find out what is to be checked".*

Respondent 5 - *"When learners are given project there is a particular time frame given. that's why when we are evaluating learners progress, we need to be there in order to make sure this ones are making progress and this ones are not making progress they are delayed by this and this. I will make sure that they know the time frame".*

Respondent 6 - *"I grant them marks according to the requirement of the project. I will use a rubric to evaluate their progress".*

Respondent 7 - *“As have said I can either use rubric and it will give all the guidance I ever need, if the final product withstands all challenges, then learners are progressed”.*

Respondent 10 - *“Here I will want to determine whether the learners understand the concept very well, and I will be evaluating their progress whether they will be going to the next level so I will be using summative and formative assessment to monitor their progress If the learners this can be practical to determine what to be checked”.*

However, 3/10 teachers were not able to evaluate the learners’ progress when facilitating the evaluation stage. For example:

Respondent 4 - *“I give them a week every day I check the progress daily until I evaluate the product”.*

Respondent 8 - *“My evaluation will have to report that my leaners are progressing or not because remember if we did the investigation, design the making and we are now on evaluation meaning my learners has progressed on the stage of evaluation, according to what you have evaluated now is where we are, their reasons will determine”.*

Respondent 9 - *“Their progress can be evaluated; I can tell them to change the model or test it I will be telling them theoretically and then themselves they have to do it practically if they can be able to do whatever I will be telling them I will be able to see that this learners they can understand theoretically they can also present whatever I have said practically. So, it means in that way they will be considering fair testing of the model”.*

4.2.7 Explanation phase

Communication is one of the most important stages of the design process and in this stage, the learners are expected to justify the procedures followed by the design process. In this theme, the researcher asked the teachers, *“How do you facilitate different concepts to enhance the learners’ understanding when facilitating investigation, design, making, and evaluation stages?”* The response below shows how each teacher responded based on the following categories.

4.2.7.1 Investigation stage

When looking at how the teachers facilitate the different concepts to enhance the learners' understanding when facilitating the investigation stage, the data revealed that 6/10 teachers were able to facilitate the different concepts to enhance the learners' understanding when facilitating the investigation stage. The teachers indicated that they would observe when the learners were collecting information and they made the learners to share what they were doing during their investigations and what they explored. The data indicated that the teachers used the learners' explanation to identify their misconceptions and to clarify them. For instance:

Respondent 3 - *“Practical will be accompanied by communication, I am going to observe through the implementation of the experiment that’s where I will understand that the learners were not understanding what I was saying. In order to address that misunderstanding or the communication breakdown the information have to be repeated”*.

Respondent 4 - *“As long they come with different concepts, I will define it to them, I will differentiate it and I will explain further”*.

Respondent 5 - *“I will give my learners platform to explain the whatever the idea they have explored. They will be telling us how they investigated and what did they explored during the investigation”*.

Respondent 6 - *“Firstly you have to tell or explain to the learners what is expected from the investigation. What is to do when we investigation. When we investigate, we give you platform to go and come with information that each and every information you collect it”*.

Respondent 7 - *“By ensuring that learners to phrase hypothesis and how to do investigative questions and let them how to collect data”*.

Respondent 9 - *“Communication is important because on technological design process that’s the final stage where we are presenting the solution. So, through this presentation of solution we have to consider our first step up to this point because first step is the investigation where they do research but here, we are actually presenting*

the solution through sharing of ideas and from those ideas we will get the feedback. So, me, my learners will be sharing ideas and they give each other feedback I will also give them feedback and then it means they will be having improvement after the feedback. So, from there I will be inheriting their understanding of this technological design process”.

However, 4/10 teachers were not able to facilitate the different concepts to enhance the learners’ understanding when facilitating the investigation stage. For example:

Respondent 10 - *“In communication practical will be accompanied by communication I am going to observe through the implementation of experiment that’s where I will understand that the learners were not understanding or not. In order to understand that misunderstanding or the communication break down the information have to be repeated I will be able to understand where learners have not understood well it work for me to repeat so that I know where I am going. To me it works very well to repeat so that those who missed me will get where I am going”.*

Respondent 1 - *“I ask learners to look around and find the problem and how to express it to make them aware that they are problem solvers”.*

Respondent 2 - *“When you investigate you are researching something you want to know, what is this? Where does it apply? where do you find it? what it is used for? In other words, you want to check if you find information relating to that, in fact you need information about that particular thing. For example, when you want learners to make investigation on a bridge the learners must first know what are supposed to be used when you make a bridge, is it necessary for us to have a cement? Is it necessary for us to have corrugated irons? Is it necessary for us to have technicians? The financing part is also going to be investigated”.*

Respondent 8 - *“The learners will have one phenomenon to look at. Meaning their investigation is likely to be similar in terms of the concept because I think if we have to give them one phenomenon to look at maybe there is a problem of a admin block at your school and then they will have a concept to design for your school and admin block and then it means the learners are going to look at admin block they are going to investigate an admin block so it means the concept they are going to come with*

they are likely going to be the same, but they may not all be the same. So, I will then enhance that just to clarify here and there on the issues that are not the same, but they are likely to be the same if the concept is one”.

4.2.7.2 Design stage

When looking at how the teachers facilitate the different concepts to enhance the learners’ understanding when facilitating the design stage, the data revealed that 5/10 teachers are able to facilitate the different concepts to enhance the learners’ understanding when facilitating the design stage. The data indicated that the teachers explain the plan in detail and clarify some concepts whenever the learners did not understand. For instance:

Respondent 2 - *“Communication means you must bring what you have designed in paper you must be in the position to write and explain what is there for example when you designed a plan you must be in a position to explain the plan in details and you must even explain what are some of the symbols meaning of that particular plan so that you are the one who owns the plan, you know the plan you communicate it verbally so that everybody who look at that plan must in a position to read the plan and communicate the plan the same way you communicate it”.*

Respondent 6 - *“I tell the learners by designing is when you are designing is when you write some notes so that this is how product will look like, by designing is when you will have a piece of paper and a pencil you draw something down. Before you go to making you will have something drawn you must have at least three drawing then you choose from the three to best suit the project given”.*

Respondent 7 - *“I make sure that every concept I explain to them example I explain tow dimension and tree dimension so that they understand the concepts also considering the material that are going to be used”.*

Respondent 8 - *“In design learners have to do different things it will just depend which learners to say I will be preferring my admin to be like this to be in this kind of design some will say to be in the form of double story, I will then clarify again to say in this case each learner will use design for, to design a double story for the admin block I*

will clarify on what they design they may come up with, but they may not be the same. The procedure how they arrive there will be the same”.

Respondent 9 - *“Design they actually allow learners to collaborate. So, if we have different concept the understanding we be enhanced if I give them work in groups from there, we can have arguments and from those arguments we can be generating ideas from different concepts so which lead to enhancement of their understanding, then I will clarify whenever they did not understand”.*

However, 5/10 teachers were not able to facilitate the different concepts to enhance the learners’ understanding when facilitating the design stage. For example:

Respondent 10 - *“I will be checking what learners are able to design an item that was given as an activity if they managed to gather all information, I will know they understood”.*

Respondent 1 - *“I will let the learners to draw, I will let them to draw a house plan and their house”.*

Respondent 3 - *“I will be checking what learners they are able to design an item that was given as an activity. If they managed to gather all information”.*

Respondent 4 - *“I will show them practically”.*

Respondent 5 - *“I will allow them to demonstrate to us which particular object did they come about or did they come up with. I want to see their sketch where the learner will indicate that I want to design this project”.*

4.2.7.3 Making stage

When looking at how the teachers facilitate the different concepts to enhance the learners’ understanding when facilitating the making stage, the data revealed that 2/10 teachers were able to facilitate the different concepts to enhance the learners’ understanding when facilitating the making stage. The data indicated that the teachers explain to the learners the safety of tools and about realising what the learners designed in design stage. For instance:

Respondent 6 - *“What they deigned in making part you tell learners that whatever you are going to make require tools and require safety and if you will be building a house you will be needing a ceiling board and you will be cutting. Then you will know the importance of each tool. Teach them about the safety of the tools. When the learner is done with the project will submit and ask the learner which tools you used and ask about the safety measures that were applied using the tools. And asking if there were any harm while making the project”.*

Respondent 8 - *“They will be in line with what they have design. In this case I will just communicate with the learners to say if you are making, if you are practising what you have designed it means you must start looking at what you have designed, I will then question to say, this is what you designed and now this is what you are implementing why are they different so I must communicate with other learners and say this must not be different this should be the same as design. The making should be the same as design but in this case, you will be practical sing It”.*

However, 8/10 teachers were not able to facilitate the different concepts to enhance the learners’ understanding when facilitating the making stage. For example:

Respondent 9 - *“On the making stage, my learners will have to plan and develop time to attain certain type of concepts or different types of concepts because if I give them questions that states that define this problem in your own words and design in your own way, they will do so and when they come back that’s where I will let them to exchange their models and their information of certain problems they are given. From there they will start to compare and that comparison it will wake up the collaboration of why you said this how did you do this model? learners will learn from each other enhance learning in the making stage”.*

Respondent 10 - *“We ensure that whatever was done in the making, you must ensure that communication has not been broken down”.*

Respondent 1 - *“I will make learners to make after investigating the problem they design and then they will make from the design”.*

Respondent 3 - *“We must insure whatever that was been done in the making we must ensure that communication has not been broken down”.*

Respondent 4 - *“I will show them practically”.*

Respondent 5 - *“When they will be telling us about their design, I will ask them how are you going to make that is whatever you have deigned is it makeable will you be able to produce it? And if the learner agrees, it means the learner will be going through different materials and end up deciding that I am going to make this one, this project it is suitable it means it will be communicating to the investigation they are having, and it will be solving a particular problem”.*

Respondent 7 - *“To put what have been deigned together, so making hey need to know how to construct moving from part to the other learners need to know systematically until you reach the final product, I will be demonstrating to the learners how to do it”.*

4.2.7.4 Evaluation stage

When looking at how the teachers facilitate the different concepts to enhance the learners' understanding when facilitating the evaluation stage, the data revealed that 2/10 teachers were able to facilitate the different concepts to enhance the learners' understanding when facilitating the evaluation stage. The data indicated that the teachers gave the learners the one that is done correctly and explain to the learners as well as allow them to present the advantages of the project and clarify their misconceptions accordingly. For instance:

Respondent 4 - *“I will give them the correct one on the board. I will show them and explain it”.*

Respondent 5 - *“I will let my learners to present their final project saying that to compare or show us the betterment they have done in that project since I said there is nothing new is just that we are upgrading. So, I will allow my learners to present the advantages of the new project that they are having. Which will tell them that is it suitable, does it better our lives or it is taking us back. If it better our lives meaning they have accomplished their project”.*

However, 8/10 teachers were not able to facilitate the different concepts to enhance the learners' understanding when facilitating the evaluation stage. For example:

Respondent 6 - *“Before you submit the project test it yourself before submitting, if it collapses meaning there was a mistake then you will re do it and test it again. And then bring it to me. If the learner said it dint collapse, then it suits the requirement then I will re-evaluate it as a teacher if it don’t collapse the project satisfy the need”.*

Respondent 7 - *“Learners need to know that when you are evaluating there are other things you are looking for in the final product. You are going to bring in different ways of assessing or testing their final product. They need to know that their final product must withstand certain challenges if not they may go to the drawing board and fix the errors that they made because the moment the product cannot withstand challenges this mean the product has a fault in it”.*

Respondent 8 - *“I will have to make a criteria that the evaluation process should follow to be able to accommodate every learner and also to enhance learners’ evaluation, there should be a criteria to say when we evaluate this should what we look at”.*

Respondent 9 - *“If my learners are having different concepts and do not understand I will give them a chance to go on their own pace. From there that’s where they will take their eager out what they like about their product and what is that they don’t like about their product because if learners they work together and make some changes on certain product, they will all actually accommodate each other because we have different types of learners some leaners do not understand fast, and others understand fast. So, if they work together, they will have enhancement of understanding amongst this different concepts maybe as the teacher they don’t understand you but if a peer is coming and telling it will enhance their understanding because it will be testing them better than a supervision of a teacher”.*

Respondent 10 - *“I will simply impose question related to the activity that was done in class or in the practical session if the majority get it right, I will know that they understand”.*

Respondent 1 - *“I want them to know if they can draw, they need to know to budget and bring understanding into that concept”.*

Respondent 3 - *“I will simply pose one question related to the activities done in class or in the practical session, if the majority get it right meaning the learners understood”.*

4.2.8 Enclosure phase

In this theme the researcher further asked the teachers *“How do you summarise the concept when facilitating investigation, design, making, evaluation, and communication stages?”* The response below shows how each teacher responded based on the following categories:

4.2.8.1 Investigation stage

When looking at how the teachers summarise the concept when facilitating the investigation stage, the data revealed that 4/10 teachers were able to summarise the concept when facilitating the investigation stage. The data indicated that when the teachers summarise, they gave the learners the important points of design. The teachers indicated that in summary they involved everything they gathered as a form of conclusion. For instance:

Respondent 2 - *“There are things that you’re your primary aim that you want your learners to investigate, for example I say you must investigate whether you are using cement in order to make a bridge. Learners must know exactly what they are going to use since there is different types of cement which one should be used to make a very strong bridge, for example when you use sand the learners should know which sand is needed. When you summarise, you give learners realistically things that are required those are very important in the making of that particular aspect. So, the learners must know exactly”.*

Respondent 4 - *“I will explain the point and put in summary form”.*

Respondent 6 - *“I go back into the investigation and see how the learner performed in the investigation, then I compare if the investigation corresponds in the design. If the design corresponds with the investigation and in the make. I will know the learner have knowledge in the whole process”.*

Respondent 9 - *“Summery actually involve whatever that you have gathered actually it comes in a form of a conclusion actually that where you include the important ideas. On the investigation part of the design process in technology you will have to take consideration on what is that is going to be needed, what is that the learners are going to design a certain model that is required. What is that the learners will need to generate the model and the entire information which is going to be needed for the model to be implemented and then that is where we talk about possible solution”.*

However, 6/10 teachers were not able to summarise the concept when facilitating the investigation stage. For example:

Respondent 10 - *“In investigation it sometimes may be discouraging in the sense that all steps in the investigation should be followed”.*

Respondent 1 - *“I make sure learners know the English words for investigation mean the problem around, they use words like what, when why and how”.*

Respondent 3 - *“Sometimes it maybe discouraging to summarise the concept in investigation, in the sense that all steps in investigation should be followed”.*

Respondent 5 - *“When my learners are investigating, I always tell them that it doesn’t end there. That is not the final answer, it means that the idea they have investigated can be improved”.*

Respondent 7 - *“Is all about keeping it brief or short, so I am going to use the words that are familiar. I am not going to use complicated words. I will use related words”.*

Respondent 8 - *“We just look at certain specification when we look at certain scenario or a problem that we are already with we just have to look at the scenario we just say this is the key to our scenario this is what we must do, and we just summarise. At the core of the investigation, we must have this and that”.*

4.2.8.2 Design stage

When looking at how the teachers summarise the concept when facilitating the design stage, the data revealed that 3/10 teachers were able to summarise the concept when facilitating the design stage. The data indicated that the teachers highlighted the key

issues. In the design they drew the three dimensions and conclusions based on the specifications. The examples are below:

Respondent 2 - *“In the summery you highlight things that are very key in what is to be done”.*

Respondent 7 - *“I will just draw a diagram the length and breadth, in three dimension, in simple English I can use words that states the top the side and the front”.*

Respondent 8 - *“We must also have to according to the specification of this scenario this is what we are going to do”.*

However, 7/10 teachers were not able to summarise the concept when facilitating the design stage. For example:

Respondent 9 - *“Here we talk about generating solutions for a problem and we start by generating design based on the actual design process begins, so the final product will be made on what then target market of the product that will be the point of the target market of the product. we are going to use the product its appearance considering the environmental impact, the cost the quality. those are the considerations that are needed to be written down during the design stage”.*

Respondent 10 - *“I will tell the learners what I expect from them, so that they will have direction clarity of what they have to design”.*

Respondent 1 - *“I will make learners to understand that design mean drawings, learners will present to show that they are able to draw”.*

Respondent 3 - *“Tell the learners what you expect”.*

Respondent 4 - *“I design a small house and show types of lines”.*

Respondent 5 - *“I always say when they design, looking at the tools you are having. Even the design doesn't end it depend on the material you are having”.*

Respondent 6 - *“I will compare if the making corresponds with the investigation”.*

4.2.8.3 Making stage

When looking at how the teachers summarise the concept when facilitating the making stage, the data revealed that 2/10 teachers were able to summarise the concept when facilitating the making stage. The data indicated that the teachers summarise focusing on things that are important to be done and the summary is based on what is needed. For instance:

Respondent 2 - *“When people are building, they must not use any type of cement you must use in the quality of cement, in the summary you highlight things that are very key in what is to be done”.*

Respondent 9 - *“We know that we plan and develop, the question is that what is that we are planning and what is that we are developing. We need to actually follow the specification we have to list our specification on the summary here is where we are working we are doing our up and down movement in the technological process where it involves the manufacturing process. The summary will be based on what is that we need for now the material must work properly and accurate that’s where we need to monitor everything”.*

However, 8/10 of the teachers were not able to summarise the concept when facilitating the making stage. For example:

Respondent 10 - *We try to shorten the steps from something complex to something simpler. I will tell the learners to go back to the design, I will be looking at the design on what they did previously”.*

Respondent 1 - *“To make sure learners know that they will use their hand to make what they have designed”.*

Respondent 3 - *“We are trying to shorten the steps. We make something complex simpler. I will tell the learners by going back to the design. I will be looking at the designing what we did in the design”.*

Respondent 4 - *“I will show them practically”.*

Respondent 5 - *"I always tell them that if today you have made a chair that doesn't mean somebody can't come with a better idea as compared to your after some years you will feel that your ideas are outdated".*

Respondent 6 - *"I will be corresponding if the making the design and the investigation corresponds".*

Respondent 7 - *"Is all about following what you have designed. The most complicated part is to construct accordingly".*

Respondent 8 - *"We just have to follow what in the investigation and the design we did, in practice the must be the same as design".*

4.2.8.4 Evaluation stage

When looking at how the teachers summarise the concept when facilitating the evaluation stage, the data revealed that 6/10 teachers were able to summarise the concept when facilitating the evaluation stage. The data indicated that the teachers test the one that is strong and the one that is weak, hence they would be comparing. For instance:

Respondent 2 - *"In the summary you highlight things that are very key in what is to be done".*

Respondent 4 - *"I will show them the right one on the board".*

Respondent 5 - *"I tell them to weigh the advantages and disadvantages of the particular product they are making. After weighing the advantages and disadvantages is when they will be deciding when they want the one of advantages more than the disadvantages".*

Respondent 7 - *"Learners should know that the product should undergo the testing that it is strong or weak".*

Respondent 9 - *"Since this follow the making stage of these process since we are having the model. You have to ask that does the model look like in the design stage? If it is not that where you have to take some pictures for you to have evidence later on, if the object and the artifact or the model has changed, and you will start to*

compare

the actual model and the models you had before changing it, so the summary will be based on the changes that you made and the actual object before the changes that will be in the form of pictures because you will be testing the model”.

Respondent 10 - *“We are going to look at the final product, like we are going to look at what you did, we are going to find few mistakes if mistakes are there, we are going to find what to do and address those mistakes, we are going to use a quicker route. If the mistakes found, we are going to re design. If the mistakes are too many we redesign”.*

However, 4/10 teachers were not able to summarise the concept when facilitating the evaluation stage. For example:

Respondent 1 - *“I will ask them the cost of the plastic in order to know the make costs”.*

Respondent 3 - *“We are going to look at the final product, what is that we got, we might find few mistakes because mistakes are there. If mistakes are there, then how quickly can we address those mistakes. We are going to use a quicker route. Then if the mistake if found we are going to the design and re design”.*

Respondent 6 - *“You tell the learner that if it is working meaning it meet the requirement, I will test it again then I go to the mark sheet and see I give the learner so much if it meets the requirement”.*

Respondent 8 - *“We set two question or one we just summarise, what does this object, how does this object you have designed maybe how it relates or how does it connect with what you did in the investigation and your answer will say this is what we did in the investigation”.*

4.2.8.5 Communication stage

When looking at how the teachers summarise the concept when facilitating the communication stage, the data revealed that 6/10 teachers were able to summarise the concept when facilitating the communication stage. The data indicated that the teachers present the final product and indicate the advantages and disadvantages by talking about the entire process. For instance:

Respondent 1 - *“Learners will be presenting what they have made”*

Respondent 2 - *“In the summary you highlight things that are very key in what is to be done”.*

Respondent 5 - *“Communicate the advantages and disadvantages”.*

Respondent 7 - *“All about presenting the result concluding the product telling us the processes and procedure as you were busy constructing your product”.*

Respondent 8 - *“Is all about the final product. We present the functions and all final product”.*

Respondent 9 - *“Since we know that we are communicating we must have agenda that’s where when we communicate, we have audience, we write down the important points were are noting everything which is specified and also that’s where we know that communication that’s where we collaborate, that’s where we start arguments. We actually look at the specification everything which was needed for the model and check whether we did not use too much money or the high of this model is taller or were evaluate. That why there is certain feedback and new ideas”.*

However, 4/10 teachers were not able to summarise the concept when facilitating the communication stage. The teachers indicated that in communication, the learners are facilitated by communication. For example:

Respondent 10 - *“In communication learners should know that they may be facilitated by communication, you must communicate with the learners. Communication is the best everywhere”.*

Respondent 6 - *“I tell the learner you must investigate, for me to facilitate they have to tell me I got this information from google, from brother, school mate meaning this learner is good in communication”.*

Respondent 3 - *“In communication learners must know that it will be facilitated by communication”.*

Respondent 4 - *“I will tell them do this and this”.*

4.2.9 Exchange phase

In this theme the researcher further asked the teachers how they use the learners' ideas when facilitating investigation, design, making and the evaluation stages. The responses below show how each teacher responded based on the following categories:

4.2.9.1 Investigation stage

When looking at how the teachers use the learners' ideas when facilitating the investigation stage, the data revealed that 9/10 teachers were able to use the learners' ideas when facilitating the investigation stage. The data indicated that the teachers ask the learners, and they present and use their ideas and whenever the learners give examples the teachers use the learners' ideas if they understand. For instance:

Respondent 1 - *"Is the best way to get learners' interest, by asking them to look around the school, why do we need a dustbin".*

Respondent 2 - *"That one is very important that's why we start from known to unknown you first as learners questions by using question answer method, whatever they present they must use to link the information that you want with what they know that where we know is where we exchange ideas with this learner. The reason why we exchange ideas with learners is that the learners must be interested in the lesson you cannot be interested in the lesson that you don't even understand. The learners must be sure they have got. You must not bring complex things that they don't understand. That is why we want their ideas".*

Respondent 4 - *"I will use it as examples, I will use different ideas of different learners".*

Respondent 5 - *"I love learners giving examples and build on what learners are giving so that they will be able to understand better".*

Respondent 6 - *"I give them platform inside the classroom before they go out the classroom. I ask them what they have in mind or idea how he/she will do then I collect different information from learners and then tell others how to do and that will help other learners".*

Respondent 7 - *“I can say maybe I have 5 learners they can give me five different idea, me as a facilitator I take them and combine them into one thing, then it automatically be no different from what the learners has said”.*

Respondent 8 - *“I use learners’ ideas; I take them where they know I use their ideas of investigation to implement what thy know about investigation”.*

Respondent 10 - *“Education is the life learning process, I might not be known all I must have a room to accommodate learners’ idea, when learners come with idea, I must not crush learners’ idea I must accommodate that idea. That learners will gain confident and try to shape ore re direct the idea”.*

Respondent 3 - *“Education is a lifelong learner as the educator you don’t know all, you must have room to accommodate learners’ ideas”.*

However, one teacher did not summarise the concept when facilitating the investigation stage, the teacher indicated that he does not have to spoon feed the learners when they are investigating.

Respondent 9 - *“Most learners at some point they can be good researchers than a teacher, as a teacher you have to give learners chance to research before researching for them. We do not have to spoon-feed the learners when they are instigating. You have to let them to go and dig more information for their model, for certain product that need to be implemented by that way that’s where you will need to realise that this learner is right, I have to execute this information, or I have to eliminate this information, or this information is useful. That’s where u start to adventure a new thing”.*

4.2.9.2 Design stage

When looking at how the teachers use the learners’ ideas when facilitating the design stage, the data revealed that 5/10 teachers were able to use the learners’ ideas when facilitating the design stage. The data indicated that the teachers use the learners’ ideas and come with the idea that best suits the specification. The teachers also accept the different approaches of the learners in the design process. For instance:

Respondent 3 - *“Giving learners chance for those who are is eager in practical, and you can learn from learners, the learners may come with different approach if a learner come with something the teacher must consider their opinion”.*

Respondent 4 - *“I would use plan for the future years the ideas in design if some drew a good plan, I would show learners in the coming years”.*

Respondent 5 - *“I always ask them which material ca you use, which structure, how the project that you are doing will look like, if they are able to tell me that, that’s when I will decide that the idea is of span bridge go and design a span bridge”.*

Respondent 8 - *“In this case I will say learners must design according to the scenario, while they design, I will use their ideas and I come with the idea of specifications in the design, and I say don’t forget this one and don’t forget this specification this are the things that should you include in this case I will be uplifting their ideas”.*

Respondent 10 - *“By giving learners chance for those who are good in practical, and I can learn from the learners, the learners will cum with different approach if the learner or that particular learner come with something the teachers must consider their opinion”.*

However, 5/10 teachers were not able to summarise the concept when facilitating the designing stage. For example:

Respondent 1 - *“In design learners will be told to design their own dustbin”.*

Respondent 2 - *“Every time you design anything in technology make sure that you use a rubric”.*

Respondent 6 - *“I will ask anyone to come forward and draw something on the board and ask the learners challenges, I tell them the challenges they will be facing”.*

Respondent 7 - *“Learners design differently they draw differently. they have different way of presenting material. It differs from one person from the other. Hence if I use learners’ ideas, I am also going to ensure that I interchange with my ideas as well as other learners’ idea”.*

4.2.9.3 Making stage

When looking at how the teachers use the learners' ideas when facilitating the making stage, the data revealed that 4/10 teachers indicated that they are able to use the learners' ideas when facilitating the making stage. The data indicated that the teachers normally ask the learners which material they are using to make a particular project, and the ideas drawn from the learners' response will let the teacher to identify the learners' misconception, then the teacher addresses the misconception accordingly. For instance:

Respondent 2 - *"You can ask them what you are going to use to make a bridge, then they may say we are going to use a cardboard and you say is cardboard alone then they will say with wires and whatever they bring. In real life have you see a bridge in cardboard they will say no".*

Respondent 5 - *"I normally ask them which material you need to make this project I don't decide for them. Each one will use the material that is suitable to that project".*

Respondent 7 - *"Compare it with the design stage, in terms of using learners' ideas. I take ideas of other learners and combine their ideas".*

Respondent 10 - *"Here the learner must be given chance, they must be giving chance to implement their idea as a learner it will also assist in evaluating the learner you can find out how the learners think".*

However, 6/10 teachers were not able to summarise the concept when facilitating the making stage. The teachers indicated that they give the learners a model to work on. They also give the learners a model and they must analyse for the learners to analyse it. For example:

Respondent 1 - *"I will tell the learners to that there are 5 stages, and I will explain them".*

Respondent 6 - *"That I am going to design this then I will be using a grinder. The safety must be known. I tell the learners that if you will be designing this do you have a grinder".*

Respondent 3 - *"The learner must be given chance".*

Respondent 8 - *"I will just use the same strategy as design because if I am going to know what learners know to where exactly I want them, they will just have to practicelike what they already design I will also come to them to say remember you must not forget this and that when implementing the design".*

Respondent 9 - *"Most of the learners when I give them a model, I also give them my model being done, when we come back to that they won't see the same, be the same appearance, they won't be the same type. It might happen that me as their assessor my model costed much compared to their model. So, I will ask them what they have to do for their model to have the lesser weight and then the size which is appropriate".*

4.2.9.4 Evaluation stage

When looking at how the teachers use the learners' ideas when facilitating the evaluation stage, the data revealed that 4/10 teachers are able to use the learners' ideas when facilitating the evaluation stage. The data indicated that the teachers use a rubric to use the learners' ideas from where the learners responded on some questions imposed on them questions such as "why are you using the material? Why do you think the material is relevant and what are the advantages?" For instance:

Respondent 4 - *"I will change the rubric to use the ideas of the best learner to mark".*

Respondent 5 - *"From individual I will ask them why you used this material? why do you think this material is suitable? What are the advantages? What are the disadvantages of using this one? So that as learners they will learn that this material is better than this one".*

Respondent 8 - *"I will look at the ideas of the learners and I will say think about this in this way and this in your ideas and evaluate, if learner come with something at the later stage record and add it at the later stage and I will comment to it at the end".*

Respondent 9 - *"Since I will be having my model and their model, they will be having many questions and they will be having suggestion, so you have to consider their suggestions. So, if I let them to change their model it might look authentic than before that why we have to use their ideas we do not have to inhibit them, let them express*

their own ideas and make their own changes let them test the model themselves from there you can learn from them”.

However, 6/10 teachers were not able to summarise the concept when facilitating the evaluation stage, the learners evaluated on what they want of the product. For example:

Respondent 10 - *“As I said before that whatever that they implemented it must be like is right you must make them feel that is the correct thing”.*

Respondent 1 - *“Is about costing we have different types of dustbin some steel less some plastic and cupboard. Learners have to evaluate on the material”.*

Respondent 2 - *“You can ask them what you are going to use to make a bridge, then they may say we are going to use a cardboard and you say is cardboard alone then they will say with wires and whatever they bring. In real life have you see a bridge in cardboard they will say no”.*

Respondent 3 - *“You established whatever that you are thought if is right”.*

Respondent 6 - *“We will have to test it, if from the start it does not meet the requirement meaning it doesn’t meet the requirement”.*

Respondent 7 - *“Every learner knows very well what is looking for, then if one is asked to make a house one is making double store and the other is making triple story the fact is the building must be strong. So, learners will be evaluated on what they want of the product”.*

4.2.10 Summary of RQ 1

Research question one explores the challenges faced by the Grade 9 Technology teachers when facilitating the design process. This research question used interviews to collect data.

In the Elicit phase, the study found that during interviews, most teachers indicated that they were able to elicit the learners’ prior knowledge in the investigation, design, and evaluation stage. However, the teachers did not indicate how they elicit the learners’ prior knowledge during the making and communication stage. During the

investigation stage, the teachers indicated that to elicit the learners' prior knowledge, they use questions and a baseline assessment to find out what they have been taught which assists them to assess the learners' prior knowledge. During the design stage, the teachers revealed that they elicit the learner's prior knowledge through diagrams and drawings. During the evaluation stage the teachers indicated that they establish the outcome of the activities. The study further found that most of the teachers use different teaching modes such as activities to elicit the learners' prior knowledge through questioning and through a baseline assessment.

During the design stage, the teachers revealed that they elicit the learner's prior knowledge through diagrams and drawings. During the evaluation stage, the teachers indicated that they establish an outcome of the activities and use it to assess their tasks. The study further found that most teachers use different teaching modes such as researching and collecting information to elicit the learners' prior knowledge in the investigation and the evaluation stages. However, most teachers were unable to indicate that they use a different teaching mode to elicit the learners' prior knowledge in the making stage. During the investigation stage, most teachers indicated that they use practical activities to elicit the learners' prior knowledge. During the evaluation stage, most teachers indicated that they use the learners' demonstrations and assess the product.

In the engaging phase, the study found that during the interviews, most teachers indicated that they were able to keep the learners as active participants in the design stage only. However, most teachers were unable to indicate how they keep the learners active in investigation, making, evaluation and in the communication stages. During the design stage, the teachers indicated that they engage the learners in drawing sketches and using instruments.

In the exploration phase, the study found that during the interviews most of the teachers indicated that they were able to introduce a new topic to the learners when facilitating the design stage.

However, most of the teachers were unable to indicate how they introduce a new topic to the learners in the investigation, making and the evaluation stages. During the

design stage, most teachers indicated that they involve the learners in drawing anything they think of with measurements, it can be a box or a classroom.

In the enlightening phase, the study found that most teachers during the interviews indicated that they were able to relate the different concept to the topic during the investigation and making stages. However, most teachers were unable to indicate how they relate the different concepts during the design and evaluation stages. During the investigation stage, most teachers indicated that they use different sources to compare topics, by comparing information with other subjects (learning areas). During the making stage, most teachers indicated that they gave examples and do hands on activities asking the learners questions and showing them how to take measurements.

In the elaboration phase, the study found that most teachers indicated that they were able to connect everyday experiences with the topic in the investigation stage. However, in the design, making and evaluation stages, the teachers were unable to indicate how they connect everyday experiences with the topic. During the investigation stage, most teachers indicated that they collect information and advice from the learners when they start a topic and link real life experiences with the topic. The study further found that, most teachers during the interviews indicated that they were able to support the learners to use tools, build, and test the product when facilitating design, as well as in the making and evaluation stages. During the design stage, most teachers indicated that they make sure that they have all the equipment readily available. During the making stage, most teachers indicated that they consider the safety of the learners when using tools and ensure that all the resources are available. During the evaluation stage, most teachers indicated that they support the learners by comparing and testing the strengths and weaknesses of the material.

In the evaluation phase, the study found that most of the teachers during the interviews indicated that they were able to evaluate the learners' decision and problem-solving techniques in the investigation stage. However, most teachers were unable to indicate that they are able to evaluate the learners' decision and problem-solving techniques in the evaluation stage.

During the investigation stage, most teachers indicated that they do not limit the learners' information, as the learners come with different ideas, and they also indicated

that there is a need for a rubric to evaluate the learners' process. The study further indicates that, most teachers were able to evaluate the learners progress in the evaluation stage. During the evaluation stage, most teachers indicated that they assessed the criteria either by using a rubric for the summative and formative assessments to monitor the learners' progress.

In the explanation phase, the study found that, most teachers during the interviews indicated that they were able to facilitate the different concepts to enhance the learners understanding in the investigation stage. However, most teachers were unable to indicate that they facilitate different concepts to enhance the learners understanding in the design, making and the evaluation stages. During the investigation stage, most teachers indicated that they observe when the learners are collecting information and they make them to share what they were doing during their investigations and what they explored during the investigation. The teachers then use the learners' explanation to identify their misconceptions and clarify them.

In the enclosure phase, the study found that most teachers during the interviews indicated that they were able to summarise the concept in the evaluation and communication stages. However, most teachers were unable to indicate that they summarise the concept in the investigation, design, and the making stages. During the evaluation stage, most teachers indicated that they test the one that is strong and the one that is weak, hence they would be comparing. During the communication stage, most teachers indicated that they allow the learners to present the final product and indicate the advantages and the disadvantages and they conclude by talking about the entire process.

In the exchange phase, most teachers during the interviews indicated that they were able to use the learners' ideas when facilitating the investigation stage. However, most teachers were unable to indicate that they use the learners' ideas when facilitating the design, making and the evaluation stages. During the investigation stage, most teachers indicated that they ask the learners to present and use their ideas. Whenever the learners give examples, the teachers use the learners' ideas whether they understand or not and the teachers also accept the learners' ideas and shape or direct their ideas.

4.3 Research Question 2:

Research question 2 explored how the Grade (9 Technology teachers facilitate the Mini-PAT in the Technology classroom This research question used the non-participant observation method to collect data. The data below is a narrative story on how the lesson was presented.

4.3.1 Description of the teacher

4.3.1.1 Teacher A

Teacher A is 42 years old and is permanently employed. He is teaching Technology in Grade 8 and 9. The teacher's highest qualification is an MSc in Environmental management (MGS)and a Postgraduate Certificate in Education (PGCE) in NS.

4.3.1.2 Teacher B

Teacher B is 27 years old and is permanently employed. She is teaching Technology in Grade 9. The teacher's highest qualification is a B. Ed. (SPF).

4.3.1.3 Teacher C

Teacher C is 59 years old and is permanently employed. He is teaching Technology in Grade 8 and 9. The teacher's highest qualification is a NPDE.

4.3.1.4 Teacher D

Teacher D is 31 years old and is permanently employed. He is teaching Technology in Grade 8 and 9. The teacher's highest qualification is a BSc and a PGCE in Technology.

4.3.2 Lesson presentation

4.3.2.1 Teacher A

Investigation Design Making Evaluate Communicate

GRADE 9 C

The teacher starts by greeting the learners. The teacher introduces the topic on hydraulics and pneumatics. The teacher writes notes about pulleys and the teacher defines a pulley with examples (9 minutes). The teacher observes the COVID 19 regulations.

The teacher gives an explanation on what pulleys are and where they are found. The teacher gives an example on a mechanic workshop. The teacher further gives a demonstration on a pulley system for example, a wheelbarrow, a rope, and a belt (elaboration phase). An example of a single pulley is given. He further gives an example of lifting the table. The teacher gives an example of a mechanical advantage pulley and a wheelbarrow. The learners choose the one that will not be heavy between the hard lifted and the wheelbarrow and the teacher demonstrates that the more pulleys are used, the easier it is to lift the load (enlightening phase). The teacher further writes a formula for mechanical advantage and says the MA is less than 1 (<1), mean no gaining mechanical advantage.

The learners responded on the opposite of gaining they said LOOSE. The learners wrote notes accordingly. All the learners were focused and disciplined. The teacher explained that the one being pulled failed, learners are sharing textbooks (explanation phase). The teacher advised them to refer to their textbooks. The teacher gives an example in terms of a ship when loading off goods. The teacher uses a formula and lets the learners to write the formula down **MA = L / E**

$$\mathbf{L = MA \times E}$$

$$\mathbf{E = L / MA}$$

The teacher gives the learners examples of how to calculate mechanical advantage. The teacher advises the learners to use their notes and gives the learners classwork, where they have to give examples where pulleys can be used (evaluate phase). To define pulleys, and to calculate the effort of machine, the teacher asks the learners to respond individually while checking and monitoring their work. Learner 1 could not respond accordingly.

Learner 2 got it right. The teacher marked the learners work individually, while the others were still writing. The teachers checked the learners' work while they were still writing meaning he assisted the learners (evaluation phase). Learner 3 stood up seeking to be assisted by the teacher. Learner 4 volunteered to answer question 3 and calculate on the board. The teacher instructed all the learners to write the formular

down as part of the corrections. The teacher explains the formula and how to use data. The teacher gives the learners homework.

4.3.2.2 *Teacher B*

Investigation Design Making Evaluate Communicate

GRADE 9 D TIME: 11: 30

TOPIC STRUCTURES

The teacher asked the learners what a structure is. The learners did not respond. The teacher explained the concept of structures and reminds them that they will write a test in due course (explanation phase).

The teacher wrote the definition on the board. The teacher asked the learners to give examples of structures, and the learners gave the types instead of examples. The teacher gave a hint on the examples of structures that are in the classroom such as tables and chairs. The teacher further engaged the learners in answering and they managed to give examples (evaluation phase). The learners managed to give the types of structures. The teachers asked the learners to give the differences between the types of structures for example, shell structure, frame structure, and the solid structure.

The teacher tried to define each type of structure and wrote it on the board for example, shell structure and then he asked the learners to give examples. The learners responded correctly.

Learners 2 did not get it correct and Learner 3 got it correct.

Learner 2. Responded incorrectly on frame structure learner 1 responded correctly. The teacher asked for examples- Learner 1 responded correctly and tried to explain further. Learner 2 responded correctly. Learner 3 responded correctly. The teacher gave an example of desk and tried to explain further. Learner 4 and Learner 5 got it correct.

Mass structure. Learner 1 correctly responded to the teacher and further asked why mass structure is using its weight to support its load. The teacher explains further.

Learner 2 gives a correct example. Learner 3 got it wrong, and the teacher gave clarity on it and further gave an example. The teacher allowed the learners to copy the notes on the board.

The teacher gave the learners the types of loads, then the lesson was disturbed as the teacher was called.

The lesson resumed, the teacher wrote the types of loads on the board (i) Static load (ii) Dynamic load (iii) Even load and uneven load.

The teacher asked the learners to explain each load.

1. Static load – No learners got it right and the teacher explained it.
2. Dynamic load – The teacher explained it and gave an example.
3. Even load – No learner responded correctly.
4. Uneven – One learner responded correctly, after the teacher gave a clear explanation.

The teacher tried to give the learners examples of local bridges (elaboration phase).

The teacher gave classwork and then allowed each learner to present their answers. The teacher took the most correct answers (evaluating phase).

4.3.2.3 *Teacher C*

DAY 1 Investigation Design Making Evaluate Communicate

TOPIC STRUCTURES

The teacher introduced a topic on structures by giving the learners a background on structures. He asked the learners the types of structures and their functions (exploration phase). The learners responded accordingly, and they were allowed to discuss in groups while the teacher was observing from a distance. The learners participated individually, and the teacher asked the learners to write and categorise the examples of each type of structure. According to their examples, the teacher went through the learners work and assessed the learners individually. In some instances,

the teacher allowed each learner to present what they wrote (explanation phase). The teacher gives the learners feedback on what was expected from them. Then the teacher used a chart where the learners observed the categories of structures as natural and man-made structures. The learners discussed their presentations where some learners brought their examples that accompany their arguments. The teacher allowed the learners to give the functions of each structure. The learners gave different explanations. The teacher gave the learners a project to work on. They were meant to make a chart where they had to cut pictures from magazines, books, and newspapers on the structures. The learners were meant to make a flow chart and indicate whether the structure is a man-made or a natural structure (exploration phase) and learners indicated their functions and the materials that they had used.

The teacher also indicated that if the learner does not find a picture that is not clear they can supplement by using a visible freehand drawing (exploration phase). The teachers gave them a period of 3 days to submit on the next coming lesson since the learners were attending school on a rotational basis (Covid-19 regulations).

GRADE 9 B

DAY 2

The teacher asked the learners about the project given in the previous lesson and told the learners what is expected from the project. The teacher checked the learners work (individually) (evaluation phase). All the learners did the project individually. The teachers sampled the learners to present their charts on what is expected from their charts and reminded them of their drawing skills where the learners were allowed to comment on their peers' drawing skills based on the drawing technique (evaluation phase). The teachers commented on what was supposed to be done when drawing the diagrams. The teacher further instructed the learners to exchange their project work. The learners were allowed to correct each other's project (chart) by giving comments on what is wrong in the chart. Then learners commented on what the other learners did (explanation phase), and some learners commented on the good things the other learners did. Some learners managed to spot errors on what their peers did wrong. Some commented on using a pen when drawing and some learners commented on identifying the function. Some said the function of the bridge is only for

cars to pass through and the learners went into a discussion. Then the teacher concluded by giving a detailed explanation with examples and highlighted that the size of the bridge also determines the load that must pass through (enclosure phase).

4.3.2.4 *Teacher D*

Investigation Design Making Evaluate Communicate

GARDE 9

DAY 1

TOPIC STRUCTURES

The teacher asked the learners about the structures- what they understand about structures based on what they did the previous day. The teacher wrote everything the learners said on the board. When the learners were done with their responses the teacher clarified based on what the learners had said on what is written on the board (exchange phase). The teacher gave examples and scenarios from the learners' inputs. The teacher asked the learners to give examples of structures.

The teacher showed the learners the different structures (artifacts) where the learners were able to elaborate by giving the type and the material that the artifact was made out of. The teacher let the learners discuss about the functions of each structure that was demonstrated by the teacher. The teacher recorded the learners' responses and compared them (evaluation phase). The teacher made a table and classified the categories of the structures together with their functions. The teacher asked the learners to go and investigate on the structures as homework (evaluation phase). The teacher asked the learners to draw any structure (elicit phase). They had to state what type of structure it is, the name of the structure, the function of the structure and the material that the structure is made out of.

DAY 2

The learners presented their artifact and what they wrote on the page in their prospective groups. In each group there was a group leader, and a presenter and both were answering questions from other groups. Other members from the other groups

also responded accordingly. The teacher further gave an explanation and clarification after all the groups had presented. He then made a conclusion on all the presentations and answered all the questions (enclosure phase).

4.3.3 Summary of RQ2

Research question two explored the Grade 9 Technology teachers' ability to facilitate the Mini-PAT in Technology classroom. The study observed four Technology teachers in their classroom. The study found that 2/4 teachers were able to elicit the learners' prior knowledge when facilitating the investigation and the design stages. However, most of the teachers were unable to facilitate the learners' prior knowledge during the making and the design stages. During the investigation stage, the teachers were observed when they collected information from the learners. During the design stage, the study revealed that the learners were compiling charts and pasted pictures from magazines, books, and newspapers about the structures. The study further found in the elicit phase that 2/4 teachers were able to use different modes to elicit the learners' prior knowledge in the investigation stage. The study found that most teachers were able to use a different teaching mode in the evaluation stage. However, most teachers were unable to elicit the learners' prior knowledge in the making stage. During the investigation stage, the study revealed that the teachers allowed the learners interaction. The learners discussed about the chart that the teacher brought in class. During the evaluation stage, the study revealed that the teachers sampled the learners to present and observe what was expected from their charts.

In the engagement phase, the study found that most teachers were able to keep the learners as active participants in the investigation, evaluation, and the communication stages. During the investigation stage, all the teachers were able to keep the learners as active participants. During the evaluation stage 3/4 teachers were able to keep the learners as active participants. During the communication stage all the teachers were able to keep the learners as active participants. However, in the design and the making stages most teachers were unable to keep the learners as active participants.

In the investigation stage, the study revealed that most teachers asked the learners based on the previous day's work on structures where they had to search information on structures and the learners responded accordingly.

During the evaluation stage, the study revealed that most teachers allowed the learners to comment on their peers' drawing skills based on the drawing techniques.

During the communication stage, the study revealed that most teachers gave clarification after all the groups had presented.

In the exploration phase, the study found that 2/4 teachers were able to introduce new concept to the learners in the investigation and the evaluation stages. However, most teachers were unable to introduce a new concept in the design and the making stages.

During the investigation stage, the study revealed that the teachers showed the learners the different artifacts where the learners elaborated by giving the types and the material that the artifact was made out of. In the evaluation stage, the study revealed that the teachers recorded the learners' responses.

In the enlightening phase, the study found that 2/4 teachers were able to relate the different concepts in the investigation and the evaluation stages. However, most teachers were unable to relate the different concepts in the design and making stages.

During the investigation stage, the study revealed that the teachers had shown the learners the different structures where the learners were able to discuss and give the types of materials the artifact was made of. During the evaluation stage, the study revealed that most of the teachers used object demonstration to evaluate learners.

In the elaboration phase, the study found that 2/4 teachers were able to connect everyday experiences with the topic in the investigation and the evaluation stages. However, most teachers were unable to connect everyday experiences in the design and the making stages. During the investigation stage, the study revealed that the teachers asked the learners what they understand about the structures and wrote the learners ideas on the board. During the evaluation stage, the study revealed that the teachers listened to the learners' presentations on their models in relation to their model on bridges. The study further found that 2/4 teachers were able to support the learners to use tools, and to build and test the models in the evaluation stage. However, all the teachers were unable to support the learners in the design and the

making stages. During the evaluation stage, the study revealed that the teachers listened as the learners presented and asked them questions. The learners used their previous knowledge and personal experiences.

In the evaluation phase, the study found that 3/4 teachers were able to evaluate the learners' decision and problem-solving techniques. However, most teachers were unable to evaluate the learners' decision and problem-solving techniques in the investigation, design, and the making stages. During the evaluation stage, the study revealed that most teachers recorded the learners' responses as they present their models. The study further found that all the teachers were unable to evaluate the learners progress in the evaluation stage.

In the explanation phase, the study found that 3/4 teachers were able to facilitate the different concepts in the investigation and the evaluation stages. However, 3/4 teachers were unable to facilitate the different concepts in the design and making stages. During the investigation stage, the study revealed that most teachers gave examples and scenarios when explaining to the learners. During the evaluation stage, the study revealed that most teachers allowed the learners to present and evaluate the model using rubrics.

In the enclosure phase, the study found that 3/4 teachers were able to summarise the concept in the communication stage. In evaluation, 2/4 teachers were able to summarise the concept. However, most teachers were unable to summarise the concept in the investigation, design, and the making stages. During the evaluation stage, the study revealed that the teachers summarised what the learners have presented by focusing on the key areas reflecting on the rubric. During the communication stage, the study revealed that most teachers explained what the learners presented.

In the exchange phase, the study found that all the teachers were able to use the learners' ideas in the evaluation stage. However, most teachers were unable to use the learners' ideas in the investigation, design, and the making stages.

During the evaluation stage, the study revealed that most teachers let the learners to present and answer the questions posed to them. The teacher then used their

responses to identify the misconceptions.

4.4 Summary of the chapter

This chapter discussed the findings that emerged from the semi structured interviews of ten teachers and the classroom observations of four classes. The biographical data of the teachers that were observed is indicated on the basis of qualification, age, and gender. The next chapter provides a detailed discussion of the results of the semi structured interviews and the non-participant observations.

CHAPTER 5: DISCUSSION AND RESULTS

5.1 Introduction

This chapter presents the discussion of the main results based on two research questions.

5.2 Discussion of the results

This study explored the challenges faced by the Grade nine (9) Technology teachers when facilitating the Mini-PATs in the classroom. As indicated, to understand these challenges the study was guided by the following research questions:

RQ1: What are the challenges faced by the Grade 9 Technology teachers when facilitating the design process?

RQ2: How do the Grade 9 Technology teachers facilitate the Mini-PATs in the technology classroom?

5.3 Theory of constructive teaching

As indicated in Chapter 2, constructive teaching refers to the method of teaching that creates a situation that challenges passive learning through active learning where the learners engage, explore, question their own assumption, and build new knowledge through exploration by guiding and considering prior knowledge. As indicated earlier, the data was collected through the interviews with ten teachers and observations with four selected teachers. The selection of the observation participants was based on their performance during the interview where two teachers who responded positively and two teachers who were not clear in their response were chosen. In this discussion, the focus was on the ten teachers' responses during the interviews and there was a further discussion on the responses of the four teachers during the interviews.

5.3.1 Understanding the constructive teaching theory through the 9E instructional model

5.3.1.1 Elicit phase

The elicit phase was explored within the investigation, design, making and the evaluation stages where the teacher considered the learners' prior knowledge. The study found that during the interviews, 7/10 teachers indicated that they were able to

elicit the learners' prior knowledge in the investigation stage, while 6/10 got it in the design stage and 7/10 in the evaluation stage. However, the teachers did not indicate how they elicit the learners' prior knowledge during the making and the communication stages. During the investigation stage the teachers indicated that to elicit the learners' prior knowledge they use questions and baseline assessments to find out what they have been taught which assists them to assess the learners' prior knowledge. During the design stage the teachers revealed that they elicit the learners' prior knowledge through diagrams and drawings. During the evaluation stage the teachers indicated that they establish the outcome of the activities. The study further found that most of the teachers use different teaching modes to elicit the learners' prior knowledge through questioning and baseline assessments.

During observation, two teachers were able to elicit the learners' prior knowledge while the other two teachers were unable to elicit learners' prior knowledge. During observation, two teachers elicited the learners' prior knowledge during the investigation stage and the other two teachers elicited the learners' prior knowledge during the design stage. However, only one teacher was able to elicit the learners' prior knowledge during the making and the evaluation stages. Therefore, this indicates that most teachers have challenges in creating activities that elicit the learners' prior knowledge in most technological stages. In addition to these findings, when analysing the data, I observed that two teachers who did not respond properly in the interview did not elicit the learners' prior knowledge during the observations while the other two teachers who responded properly were able to elicit the learners' prior knowledge during the observation stage. According to the data collected from the two teachers who did not respond properly in the interview and observation stages had a MSc in Environmental MGS, a PGCE NS qualification and a NPDE qualification. While the other two teachers who responded properly during the interview and observation stages hold a Bed SP/FET qualification and the other one with a BSc has done PGCE in Technology. The data indicates that most of the teachers considered the learners' prior knowledge, and the teachers who have limited knowledge of the Technology subject struggle to identify the relevant activities that can elicit the learners' prior knowledge.

5.3.1.1 Engaging phase

The engagement phase was explored within the investigation, design, making, evaluating, and communicating stages where the teacher involves the learners throughout the lesson as active participants. During the interviews, the study found that most teachers indicated that they were able to keep the learners as active participants in the design stage. However, most of the teachers were unable to indicate how they keep the learners active in the investigation, making, evaluation and communication stages. During the design stage, the teachers indicated that they involve the learners in the drawing sketching and using instruments stages.

During observation, four teachers were able to keep the learners as active participants in the investigation and communication stages; three teachers did this in the evaluation stage and only one teacher was able to keep the learners as active participants in the design and making stages. Therefore, only one teacher was able to keep the learners active in all the designing stages. When analysing the data, the researcher observed that the teachers who did not respond well in the interviews during the making stages were not able to keep learners as active participants in the making stage during classroom observation. However, there is one teacher who responded properly in the interview and was able to keep the learners as active participants in all the designing process.

5.3.1.2 Exploration phase

The exploration phase was explored within the investigation, design, making and evaluation stages where the teacher initiates the activities and discusses the background and provides material and equipment. The teacher addresses the learners' misconceptions.

The study found that during the interviews most teachers indicated that they were able to introduce new concept to the learners when facilitating the design stage. However, the teachers did not indicate how they introduce the new concept to the learners when facilitating the investigation, making and the evaluation stages.

During the design stage, the teachers indicated that to introduce a new concept to the learners, they give the learners activities on drawings, where the learners draw

dimensions and use correct instruments. During observation, two teachers were able to introduce new concept to the learners when facilitating the investigation and evaluation stages. When analysing the data, the researcher observed that the teachers who did not respond well in the interviews on the investigation state, the making and the evaluation stages were not able to keep the learners as active participants during classroom observation. The one who responded properly in the design stage was able to keep the learners as active participants in the investigation and the evaluation stages.

5.3.1.3 *Enlightening phase*

The enlightening phase was explored within the investigation, design, making and the evaluation stages where the teacher referred to the use of the topic specific strategies.

The study found that during the interviews, most teachers were able to relate the different concepts to the topic during the investigation stage as well in the making stage. However, most teachers were found not to be able to relate the different concepts during the design and the evaluation stages. During the investigation stage, the teachers indicated that they compare and explore new information in relation to other subjects. During the making stage, the teachers indicated that they implement the creativity of the learners in the availability of materials and combining information to make the final product. During observation, two teachers were able to relate different concepts to the topic when facilitating investigation and during the making stages. However, the other two were not able to relate the different concept to the topic when facilitating the design and making stages. The data revealed that only one teacher was able to relate the different concepts to the topic when facilitating the designing and making stages. The data indicates that most teachers have a challenge in relating the different concepts to the topic in technological processes. When analysing the data, the researcher observed that the teachers who did not respond well in the interviews in the design stage were not able to relate the different concepts in the design stage during classroom observation. The one who responded properly in the investigation stage was able to relate the different concepts during the investigation stage.

5.3.1.4 *Elaboration phase*

The elaboration phase was explored within the investigation, design, making and the evaluation stages where the teacher relates real-life experiences with the new concept within the classroom context. The study found that most teachers during the interviews were able to connect everyday experiences in the investigation stage. Hence, in the making and in the evaluation stages they had equal chances to connect everyday experience and in the design stage the teachers were not able to connect everyday experience.

The study further found that most teachers were able to support the learners to use tools, build and test the product when facilitating design, as well as in the making and evaluation stages. During the investigation stage, the teachers indicated that they connect everyday experiences with the topic by identifying the problem and collecting information then by linking real life with classroom practice. The teachers further indicated that in the design stage they support the learners to use tools, build and test the product by using instruments to measure and help the learners to carry out practical activities by demonstrating to carry out these activities. During The making stage, the teachers indicated that they support the learners on safety precautions and choose the right material and during the evaluation stage the teachers indicated that they compare and test the product.

During observation, two teachers were able to connect every experience with the topic during the investigation and evaluation stages. However, all the teachers were not able to do this in the design stage. The data revealed that only one teacher was able to connect everyday experiences to the topic in the making stage. The observation further revealed that two teachers were able to support the learners to use tools, build and test the product during the evaluation stage. The data revealed that all the teachers were not able to support the learners to use tools, build and test the product during the design and the making stages.

This indicates that most of the teachers have a challenge in supporting the learners to use tools, build and test the product in most technological processes. When analysing the data, the researcher observed that the teachers who did not respond well in the interviews in the design and the making stage were not able to connect everyday

experience with the topic in the design and the making stage during classroom observation. The one who responded properly in the investigation stage was able to connect everyday experience with the topic during the investigation stage. When analysing the data on the teachers who were able to support the learners to use tools, build and test the product, the teachers who responded well in design stage, were able to support learners to use tools, build and test the product in the design stage in classroom observation.

5.3.1.5 Evaluation phase

The evaluation stage was explored within the investigation, design, making and the evaluation stages where the teacher determines the evidence of the learners' understanding of different concepts.

The study found that during the interviews most teachers were able to evaluate the learners' decision and problem-solving techniques during the investigation stage. During the investigation stage the teachers indicated that they allow the learners opinions and use the rubric. The study also found that most teachers were also able to evaluate the learners process during the evaluation stage. During the evaluation, the teachers indicated that when they evaluate the learners' progress, they use formative or summative assessments to monitor the learner's progress. During observation, three teachers were able to evaluate the learners' decision and problem-solving techniques during the evaluation stage. However, only one teacher was able to evaluate the learners' decision and problem-solving techniques during the investigation stage. The data revealed that all the teachers were not able to evaluate the learners' decision and problem-solving techniques during the design and the making stages.

The data indicates that most teachers have challenges in evaluating the learner's decision and problem-solving techniques in most technological processes. When analysing the data, the researcher observed that the teachers who did not respond well in the interviews in the design and the making stages were not able to connect the everyday experience with the topic in the design and the making stage during classroom observation. The one who responded properly in the investigation stage was able to connect everyday experience with the topic in the investigation stage.

5.3.1.6 *Explanation phase*

The explanation phase was explored within the investigation, design, making and the evaluation stages where the teacher clarifies the learners' misconceptions. The study found that during the interviews most teachers were able to facilitate different concepts to enhance the learners' understanding when facilitating the investigation stage. During the investigation stage the teachers indicated that they give learners a chance to explain what they have gathered and clarified the learners' ideas from the information they gathered. During observation three teachers were able to facilitate different concepts to enhance the learners' understanding during the investigation and the evaluation stages. However, only one teacher was able to facilitate different concepts during the design and the making stages. The data revealed that most teachers have challenges in facilitating different concepts in most technological processes.

When analysing the data, the researcher observed that the teachers who did not respond well in the interviews in the design and making stages were not able to facilitate the different concepts in the design and making stages during classroom observation. The one who responded properly in the investigation stage was able to facilitate the different concepts in the investigation stage during classroom observation.

5.3.1.7 *Enclosure phase*

The enclosure phase was explored within the making, evaluation, and the design stages where the teacher summarises the concepts. The study found that during the interviews most teachers were able to summarise the concept in the evaluation and communication stages. During the evaluation stage, the teachers indicated that they test the one that is strong and the one that is weak and compare them. During the communication stage they indicated that they present the final product and indicate the advantages and the disadvantages. They conclude by talking about the entire process.

During observation two teachers were able to summarise the concept during the evaluation stage and three teachers were able to summarise the concept during the communication stage. However, only one teacher was able to summarise the concept

during the investigation and the design stages. The data revealed that all the teachers were unable to summarise the concept during the making stage. When analysing the data, the researcher observed that the teachers who did not respond well in the interviews in the investigation, design and the making stage were not able to summarise the concept during the design and the making stages during classroom observation. Those who responded properly in the evaluation and the communication stages were able to summarise the concept during the evaluation and the communication stages during classroom observation.

5.3.1.8 Exchange phase

The exchange phase was explored within the investigation, design, making and the evaluation stages where the teacher use the learners' ideas to identify misconceptions and further use them to correct those misconceptions. The study found that during the interviews most teachers were able to use the learners' ideas in the investigation stage. During the investigation, the teachers indicated that they let the learners present and use their ideas and whenever the learners give examples the teachers use the learners' ideas to clarify misconceptions. During observation, all the teachers were able to use the learners' ideas during the evaluation stage. However, only one teacher was able to use the learners' ideas during the investigation and the design stages. The data revealed that all the teachers were not able to use the learners' ideas during the making stage. When analysing the data, the researcher observed that the teachers who did not respond well in the interviews in the design and the making stage were not able to use the learners' ideas during the design and the making stages during classroom observation.

5.3.2 Challenges faced by the Grade 9 Technology teachers when facilitating the Mini-Practical Assessment Tasks in the classroom

The purpose of this study was to explore the challenges faced by the Grade 9 Technology teachers when facilitating the Mini-PATs in the classroom. The study found that most teachers were using the constructive teaching approach since they were able to create situations that challenge the assumptions of traditional teaching to constructive teaching. **Firstly**, most teachers were able to indicate how to elicit the learners' prior knowledge during the investigation, design, and evaluation stages. This was also observed during their classroom practice where most teachers were able to

elicit the learners' prior knowledge during the investigation and the design stages. However, most of them struggle to indicate how they can elicit the learners' prior knowledge during the making and the evaluation stages. Hence, most teachers were able to indicate the teaching mode they used to elicit the learners' prior knowledge during the investigation and the evaluation stage. However, it was also observed during the observation class practices where most teachers were able to use the teaching mode to elicit the learners' prior knowledge during the investigation and the evaluation stages. Therefore, most teachers struggle to use the teaching mode to elicit the learners' prior knowledge during the making stage.

According to Chernikova, Heitzmann, Stadler, Holzberger, Seidel, and Fischer (2020), the use of the learners' prior knowledge has been viewed as a good practice in starting the lesson in a classroom. **Secondly**, most of the teachers were able to actively involve the learners during the design stage. However, during observation the teachers were able to engage the learners during the investigation, evaluation, and the communication stages. Therefore, most of the teachers struggled to actively involve the learners during the design and the making stage. Similarly, Kubheka (2018) found that most of the teachers experience problems using resources when facilitating the mini-PATs. **Thirdly**, most of the teachers were able to introduce a new concept during the design stage, however, during observation the teachers were able to introduce a new concept during the investigation and the evaluation stages. Therefore, most teachers struggle to introduce a new concept in the design and the making stages. This was in line with Gumbo's (2020) findings that technology education does not integrate indigenous perspectives of technology education.

Fourthly, most teachers were able to relate the different concepts during the investigation and the making stages. However, during observation the teachers were able to relate the different concepts during the investigation and the evaluation stage. Therefore, most teachers struggle to relate the different concepts during the design and the making stage. This experience was identified by Kola (2021) where the pre-service teachers could not specify the actual teaching and learning activities.

Fifthly, most teachers were able to connect everyday experience with the topic during investigation. However, during observation the teachers were able to connect

everyday experience with the topic during the investigation and the evaluation stages. Therefore, most teachers struggle to connect everyday experiences with the topic during the design and the making stage. However, when observing how the teacher connects the learners' everyday experience with the content, most teachers were able to support the learners to use tools, to build and test the product during the design, making and the evaluation stages. However, during observation the teachers were able to support the learners to use tools, to build and test during the evaluation stage. Therefore, most teachers struggle to support the learners to use tools, to build and test the product during the design and making stage (Rambrij, 2018).

Sixthly, most teachers were able to evaluate the learners' decision and problem-solving techniques during the investigation and the evaluation stages. However, during observation the teachers were able to evaluate the learners' decision and problem-solving techniques during the evaluation stage. Therefore, most teachers struggle to evaluate the learners' decision and problem-solving techniques during the investigation, design, and the making stages. Hence, most teachers able to evaluate the learners progress during the evaluation stage. However, during observation all four were not able to evaluate the learners' progress during the evaluation stage. Therefore, most teachers struggle to evaluate the learners progress during the evaluation stage (Kola, 2021).

Seventhly, according to Kubheka (2018), to be able to facilitate the different concepts, the teacher needs content knowledge so that they may understand the possible challenges that their learners may encounter in a specific topic. Most teachers were able to facilitate the different concepts to enhance the learners' understanding during the investigation stage. However, during observation the teachers were able to facilitate different concepts during the investigation and the evaluation stages. Therefore, most teachers struggle to facilitate the different concepts during the design and the making stages. **Eighth**, most teachers were able to summarise the concept during the evaluation and the communication stages. However, during observation the teachers were able to summarise the concept during the making and the communication stages. Therefore, most teachers struggle to summarise the concept during the investigation, design, and the making stages. These findings were in line

with Kola's (2021) results indicating that the methods the teachers use did not always correspond with the topic or the learners' needs.

Finally, most teachers were able to use the learners' ideas during the investigation stage. However, during observation the teachers were able to use the learners' ideas during the evaluation stage. Therefore, most teachers struggle to use the learners' ideas during the investigation, design, and the making stages (Kola, Rauscher & Haupt, 2019).

5.4 Summary of the chapter

This chapter presented and analysed the findings of the results as raised from the semi structured interviews and the non-participant observation. The next chapter presents the study's conclusion and the recommendations. It also highlights the main findings of the study.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1 Introduction

The previous chapter discussed the findings of research question 1 on semi-structured interviews and research question 2 on non-participant observation. This chapter presents the conclusion, limitations, and the recommendations of the study. The purpose of this study was to explore the challenges faced by the Grade 9 Technology teachers when facilitating the Mini-PATs in the classroom. The study was conducted at Palala Circuit, in the Limpopo Province. This study used Amineh and Asl's (2015) theory of constructive teaching and the 9E instructional model (Ramaligela, Ogbonnaya & Mji, 2019).

6.2 Conclusion

The main purpose of this study was to explore the challenges faced by the Grade 9 Technology teachers when facilitating the Mini-PATs in the classroom. The study found that most of the teachers were unable to teach constructively by creating situations that challenge passive learning through active learning. The study found that many teachers face challenges when facilitating the Mini-PATs since they were unable to engage learners, provide materials and equipment, use topic-specific strategies, relate the content with the learners' real-life experience and connect the learners' everyday experience with the content, provide clear explanation that limit misconception, summarise the concepts, and use the learners' ideas to identify and correct misconceptions.

The study explored the main purpose through two research questions. Firstly, the challenges faced by the Grade 9 Technology teachers when facilitating the design process and the data found that most teachers said that they are able to facilitate the Mini-PATs. The study further indicated that the teachers were able to indicate how they assess the learners' prior knowledge, use topic specific strategies to teach different concepts, and relate real-life experience with the new concept to build the learners' understanding of the new concept. Lastly, the study explored how the Grade 9 Technology teachers facilitate the Mini-PAT in the technology classroom. As indicated earlier, the researcher observed four teachers to authenticate their response during interview. The study found that the teachers were unable to facilitate the design,

make and communication stages. Although most of the teachers were able to indicate what they can do during the interviews, this was a different story during observation. The study found that the teachers' response during the interviews and what the researcher observed were in contrast since during the interviews they said they are able to seek to understand the learners' ideas to find their prior knowledge. But while in observation they were able to facilitate the investigation, design, evaluation, and the communication stages.

Hence, this study concludes that most of the teachers experience challenges when facilitating the Mini-PATs in the classroom. The study further found that most of the teachers who struggle to teach Technology education lack a science or engineering background.

6.3 Limitation and recommendations

6.3.1 Limitations

The study employed the qualitative research method as stated in Chapter 3, focusing on meaning-making and on human elements. The study employed the case study design, that was meant for answering research questions. It was difficult to generalise the findings from one case to the next. To avoid the element of bias, semi-structured interviews, and non-participant observation) were used systematically. The interviews and observation were the only tools that were used to collect data. Hence, the Grade 9 learners have a greater proportion of the entire school enrolment in most schools. Most schools were subjected to rotational class attendance due to the Covid-19 regulations. The researcher was limited to observe the permissible capacity per class under the unusual conditions. The interviews were preferably done face to face by most participants despite the geographic spread of the schools that required more time to assess the participants. Due to the lack of funds, the study was confined within the Palala schools, meaning only the schools within the Palala circuit were sampled and led sampling only rural schools.

6.3.2 Recommendation

The following recommendations are aligned with the findings of the study.

- Firstly, the teachers should be provided with adequate resources that enable them to utilise their critical thinking skills when teaching the design process and

the teachers should be limiting the use of textbooks to facilitate the mini-PATs. The teachers should be well trained in practical skills to be afforded opportunities to practice real-life situations similar to what the learners' experience in the classroom.

- Lastly, the teachers should be familiarised on how to facilitate the mini-PAT through the design process. the teachers should be developed on how to engage the learners on activities, and on how to make material and equipment accessible to the learners during activities. There is also a need to learn how to use topic-specific strategies to relate the content with the learners' real-life experience and to connect the learners' everyday experience with the content. There is a need to provide clear explanations that limit misconception, on how to summarise the concept and how to use the learners' ideas to identify and correct misconceptions. Most importantly, the teachers should be prioritised based on their expertise in teaching Technology education.

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ANNEXTURE A: INTERVIEW SCHEDULE

INTERVIEW QUESTIONS

CAPS DESIGN PROCESS (DBE, 2011)

1. ELICIT PHASE

1.1 How do you elicit learners' prior knowledge when facilitating investigation, design making and evaluation stages?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

1.2 Which teaching mode do you use to elicit learner's prior knowledge when facilitating: -

Investigation stage: _____

Making stage: _____

Evaluation stage: _____

2. ENGAGING PHASE

How do you keep learners as active participants when facilitating investigation, design, making, evaluation, communication stages?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

Communication stage: _____

3. EXPLORATION PHASE

How do you introduce new concept to learners when facilitating Investigation, design, making and evaluation stages?

Investigation stage: _____

Making stage: _____

Evaluation stage: _____

4. ENLIGHTENING PHASE

How do you relate different concepts to the topic when you facilitate Investigation, design, making and evaluation stages?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation: _____

5. ELABORATION PHASE

5.1 How do you connect everyday experience with the topic when facilitating Investigation, design, making, and evaluation?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

5.2 How do you support learners to use tools, build and testing the product when facilitating design, making and evaluation stages?

Design stage: _____

Making stage: _____

Evaluation stage: _____

6. EVALUATION PHASE

6.1 How do you evaluate learner's decision and problem-solving technique when facilitating investigation, design, making, evaluation stages?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

6.2 How do you evaluate learners progress when facilitating evaluation stage?

Evaluation stage: _____

7. EXPLANATION PHASE

Communication is one of the most important stages of the design process and in this stage, learners are expected to justify the procedures followed in the design process. How do you facilitate different concepts in order to enhance learners' understanding when facilitating investigation, design, making, and evaluation stages?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluate stage: _____

8. ENCLOSURE PHASE

How do you summarise the concept when facilitating investigation, design, making, evaluation, and communication stages?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

9. EXCHANGE PHASE

How do you use learners' ideas when facilitating investigation, design, making and evaluation stages?

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

ANNEXTURE B: OBSERVATION SCHEDULE

OBSERVATION SCHEDULE

CAPS DESIGN PROCESS (DBE, 2011)

Elicit Phase:

As indicated in chapter 2, elicit phase looked at how the teacher seeks to understand learners' prior knowledge to find out what they already know. To understand teachers' mode of eliciting learners' prior knowledge, the researcher looked at **two (2) classroom practices**.

Practice one (1) on eliciting learners' prior knowledge when facilitating investigation, design making and evaluation stages?" **Practice two (2)** on teaching mode teachers use to eliciting learners' prior knowledge when facilitating investigation, making and evaluation stages. The practice further requires the teachers to elaborate. The sections below show teachers' practices based on the following categories:

Eliciting learners' prior knowledge when facilitating: -

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

The teaching mode used to elicit learners' prior knowledge when facilitating: -

Investigation stage: _____

Making stage: _____

Evaluation stage: _____

Engaging Phase

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

Communication stage: _____

Exploration Phase

Investigation stage: _____

Design stage: _____

Making stage: _____

Elicit phase: _____

Enlightening Phase

Investigation stage: _____

Designing stage: _____

Making stage: _____

Evaluation stage: _____

Elaboration phase

As indicated in chapter 2, Elaboration phase teachers looked at how the teacher relates real-life experience with the new concept within the classroom context. To understand teachers' ability to relate real-life experience within the classroom context, the researcher looked at two (2) classroom practices. Practice one (1) on connecting everyday experience with the topic when facilitating Investigation, Design, Making and Evaluation stages. Practice two (2) on supporting learners to use tools, build and testing the product when facilitating Design, Making and Evaluation stages". The sections below show teachers practices based on the following categories:

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

Support to use tools, build and testing the product when facilitating: -

Designing stage: _____

Making stage: _____

Evaluation Stage: _____

Evaluation phase

As indicated in chapter 2, Evaluation phase looked at how the teacher determines the evidence of learners' learning by assessing them. To understand how teachers determine s the evidence of learners learning, the researcher looked at **two (2) classroom practices**.

Question one (1) on how teachers evaluate learners' decision and problem-solving techniques when facilitating Investigation, Design, Making and Evaluation?" **Practice two (2)** on how teachers evaluate learners' progress when facilitating Evaluation stage. The sections below show teachers' practices based on the following categories:

Evaluating learners' decision and problem-solving techniques when facilitating: -

Investigation stage: _____

Designing stage: _____

Making stage: _____

Evaluating stage: _____

Evaluating learners' progress when facilitating: -

Evaluation stage: _____

Explanation phase

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

Enclosure Phase

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

Communication stage: _____

Exchange Phase

Investigation stage: _____

Design stage: _____

Making stage: _____

Evaluation stage: _____

APENDIX A: ETHICAL CONSIDERATION



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TURFLOOP RESEARCH ETHICS COMMITTEE ETHICS CLEARANCE CERTIFICATE

MEETING: 09 November 2021

PROJECT NUMBER: TREC/265/2021: PG

PROJECT:

Title: Challenges faced by Grade nine (9) Technology teachers' ability to facilitate Mini-Practical Assessment Tasks at Palala circuit schools, Limpopo province.
Researcher: HK Ramaboea
Supervisor: Prof SM Ramaligela
Co-Supervisor/s: Mr TI Mtshali
School: Education
Degree: Master of Education in Technology Education

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

- i) This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.
- ii) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.
- iii) PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

APENDIX B: LETTER TO THE PRINCIPAL

Name : Ramaboea H. K Department of Mathematics, Science and Technology
Education

Contact: 0734328655/ 0662785855 SCHOOL OF EDUCATION

Student No: [REDACTED] Private Bag X1106

Sovenga, 0727, South Africa

Email : hendykassey@gmail.com

The: Principal

(Science Department)

RE: REQUEST OF CONDUCTING RESEARCH WITH GRADE NINE (9)
TECHNOLOGY TEACHERS AT YOUR SCHOOL.

The above matter has reference, I **Ramaboea H.K** Student number [REDACTED] hereby request to conduct research with grade nine (9) Technology teachers as requested by the department of Mathematics Science and Technology Education (University of Limpopo) as part of my research project. The study will be taken at the following date (s) _____

I am pleading for a positive response, as my contribution will be beneficial in the learning area stated above.

Yours' faithfully

Ramaboea H.K

APPENDIX C: ACCEPTANCE LETTER FROM PRINCIPAL

LETTER OF CONSENT

PERMISSION FROM THE PRINCIPAL

Voluntary participation in the research project entitled
"CHALLENGES FACED BY GRADE NINE (9) TECHNOLOGY TEACHERS' ABILITY
TO FACILITATE MINI-PRACTICAL ASSESSEMENT TASKS AT PALALA CIRCUIT
SCHOOLS, LIMPOPO PROVINCE".

I MALOSE PHILEAS MOKOMME, the principal of BATHALERWA SEC. hereby voluntarily and willingly agree to allow my School to participate in the above-mentioned study introduced by Ramaboea H.K., currently enrolled for MEd degree at the University of Limpopo.

I further declare that I understand the informed consent as explained to me by the researcher about the role and the nature of the study to be fully aware of what the study entails.

MOKOMME MP

Full name

[Signature]

Signature

15-11-2021

DATE



SCHOOL STAMP



APENDIX D: PARENTS CONSENT FORM

Title of the study: Challenges faced by Grade nine (9) Technology teachers' ability to facilitate Mini-Practical Assessment Tasks at Palala circuit schools, Limpopo province. This serves as a request for permission to conduct research on your child while he/she will be participating on the study. Ramaboea H.K (researcher) is an educator at the school and a registered University of Limpopo Student at Masters level.

Parent/guardian

I agree that my child (Surname and name)..... will participate in a programme of research conducted by **Ramaboea H.K** at **Bahlalerwa High School**.

I understand that my daughter/son's name will be false name to maintain confidentiality.

I understand that upon request, I may have a full description of the results study after its completion.

I understand that the data from this study may be published.

I understand that I am free to withdraw from this study at any time without negative consequences.

I HAVE READ AND UNDERSTOOD THIS CONSENT FORM AND I THEREFORE, GRANT PERMISSION FOR MY CHILD TO PARTICIPATE IN THE STUDY.

Signatures

Learner's signature:

Signature of parent/guardian:

Date:

Cell/Telephone number:

APENDIX E: LEARNERS CONSENT FORM

Title of the study: Challenges faced by Grade nine (9) Technology teachers' ability to facilitate Mini-Practical Assessment Tasks at Palala circuit schools, Limpopo province.

This serves as a request for permission to conduct research on your class where you will be participating on the study. **Ramaboea H.K** (researcher) is an educator at the school and a registered University of Limpopo Student at Masters level.

Participants

- I agree to participate in a programme of research conducted by (learner's name)_____at_____High /Secondary School.
- I understand that my name will be hidden to maintain confidentiality.
- I understand that upon request, I may have a full description of the results study after its completion.
- I understand that the data from this study may be published.
- I understand that I am free to withdraw from this study at any time without negative consequences.

I HAVE READ AND UNDERSTOOD THIS CONSENT FORM AND I AGREE TO PARTICIPATE IN THE STUDY.

Signature of learner:

Date:

Cell/ Telephone number: